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**Resch et al.**

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(54) **SURFACE CLEANING APPARATUS**

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This patent is subject to a terminal disclaimer.

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**Related U.S. Application Data**

(60) Continuation of application No. 17/346,382, filed on Jun. 14, 2021, now Pat. No. 11,737,629, which is a (Continued)

(51) **Int. Cl.**  
*A47L 9/28* (2006.01)  
*A47L 11/40* (2006.01)  
(Continued)

(52) **U.S. Cl.**  
CPC ..... *A47L 9/2873* (2013.01); *A47L 5/30* (2013.01); *A47L 7/0004* (2013.01); *A47L 11/185* (2013.01); *A47L 11/302* (2013.01); *A47L 11/4005* (2013.01); *A47L 11/4008* (2013.01); *A47L 11/4011* (2013.01); *A47L 11/4041* (2013.01); *A47L 11/4094* (2013.01); *B08B 3/04* (2013.01); *B60L 53/10* (2019.02); *A46B 17/06* (2013.01); *A47L 11/4019* (2013.01);  
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(58) **Field of Classification Search**

CPC ..... *A47L 2201/022*; *A47L 9/2873*; *A47L 9/2884*; *A47L 9/2868*; *A47L 9/063*; *A47L 9/2889*; *A47L 2201/028*; *A47L 11/4005*; *A47L 11/4041*

See application file for complete search history.

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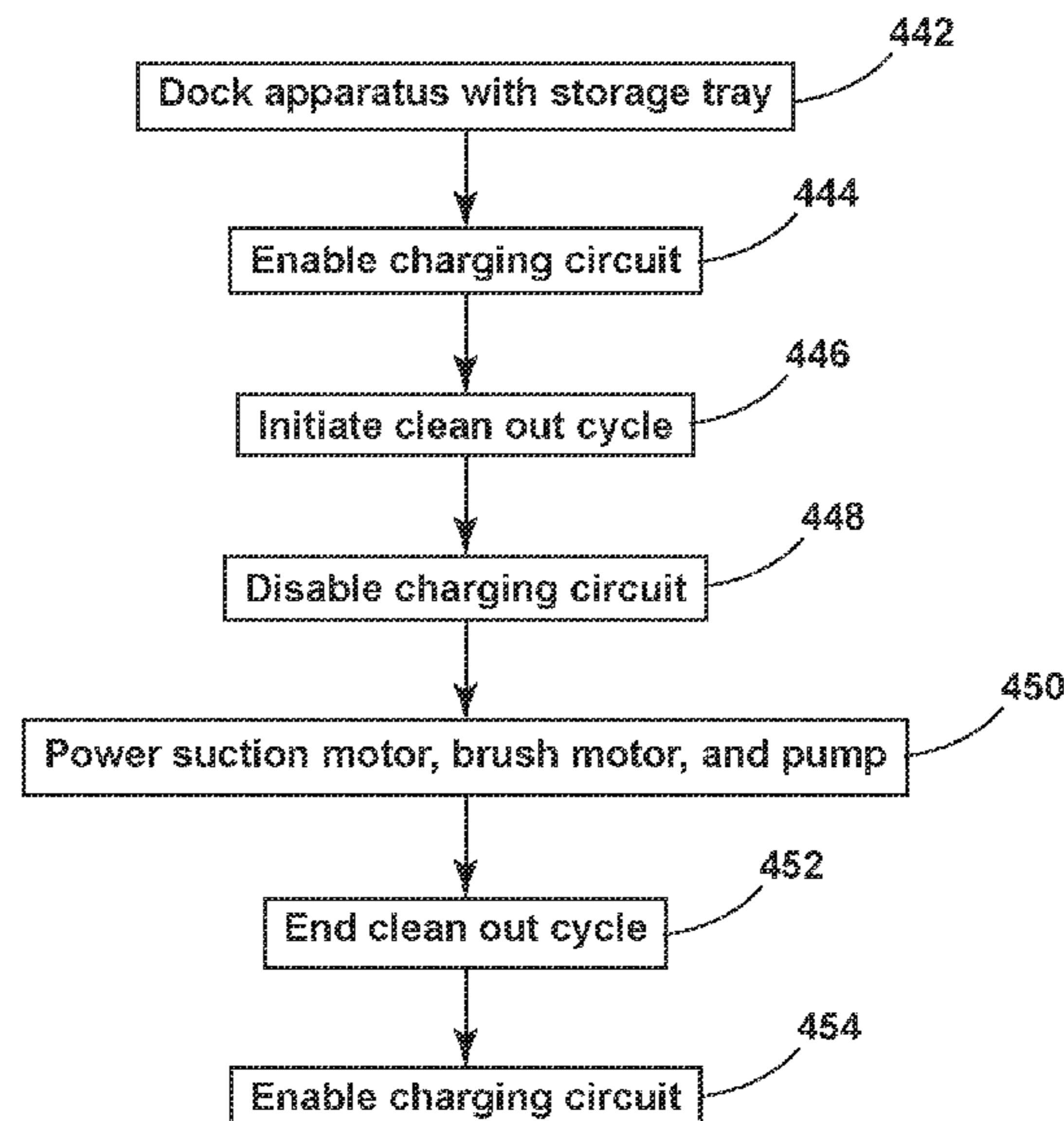
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(57) **ABSTRACT**

A surface cleaning apparatus includes an upright body and a base adapted for movement across a surface to be cleaned, a fluid delivery system, and a recovery system. The surface cleaning apparatus can be configured to clean multiple surfaces, including hard and soft surfaces, and for different cleaning modes, including wet cleaning, dry vacuum cleaning, and self-cleaning. Methods for self-cleaning a surface cleaning apparatus are also provided.

**24 Claims, 26 Drawing Sheets**

440



**Related U.S. Application Data**

division of application No. 17/016,824, filed on Sep. 10, 2020, now Pat. No. 11,071,428, which is a continuation of application No. 16/734,708, filed on Jan. 6, 2020, now Pat. No. 11,304,581.

(60) Provisional application No. 62/789,661, filed on Jan. 8, 2019.

(51) **Int. Cl.**

*A47L 5/30* (2006.01)  
*A47L 11/30* (2006.01)  
*B08B 3/04* (2006.01)  
*A47L 7/00* (2006.01)  
*A47L 11/18* (2006.01)  
*B60L 53/10* (2019.01)  
*A46B 17/06* (2006.01)

(52) **U.S. Cl.**

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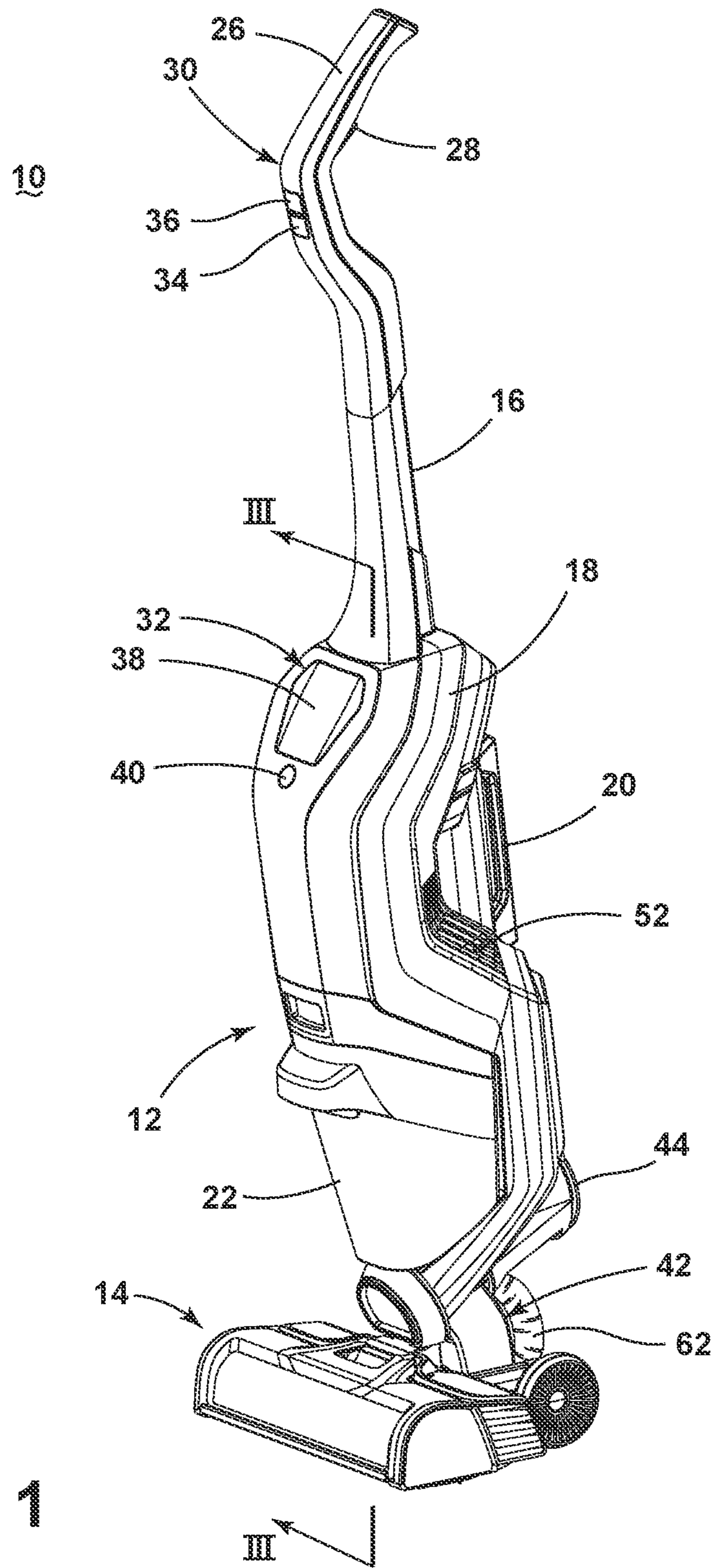
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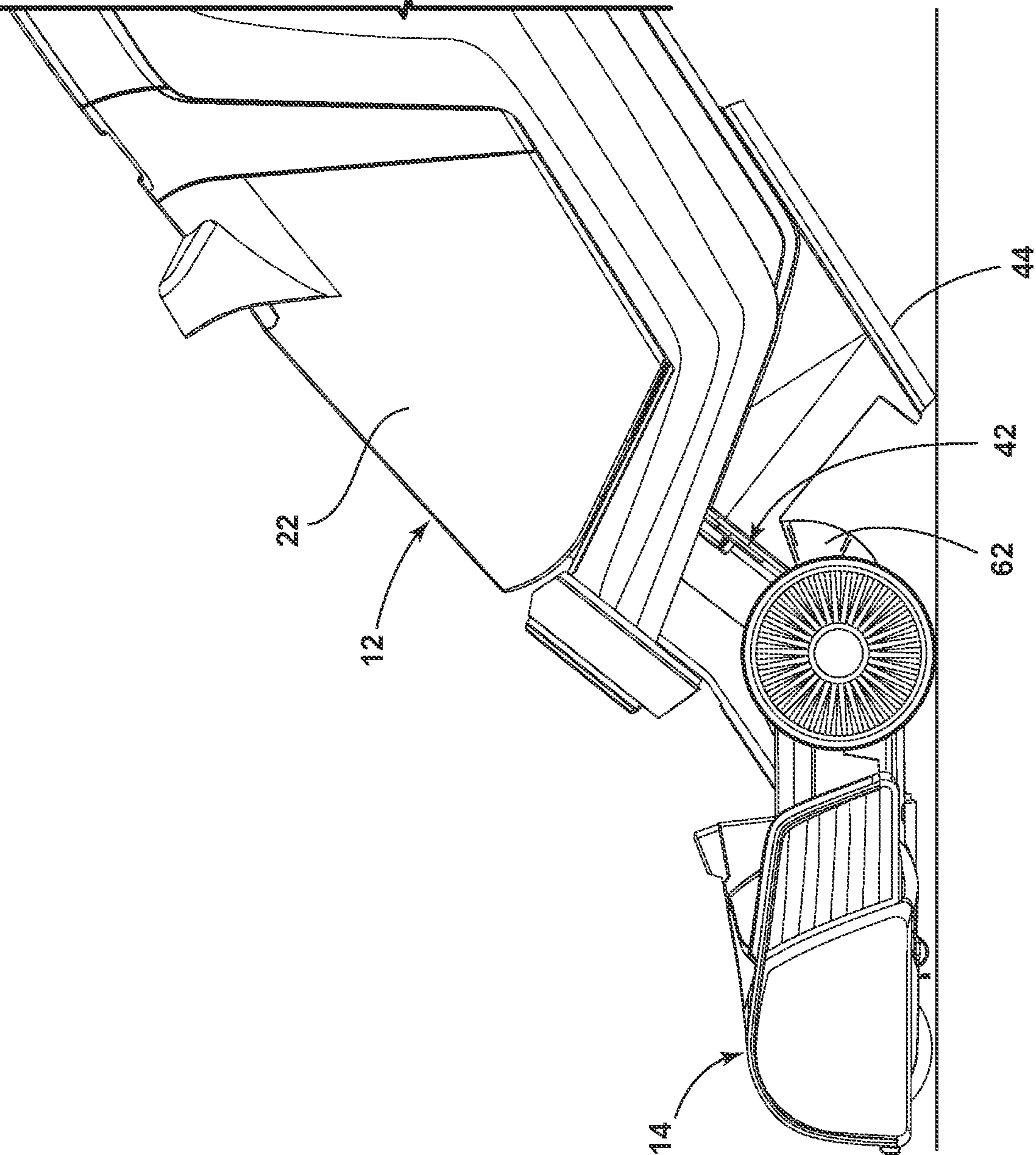


FIG. 2

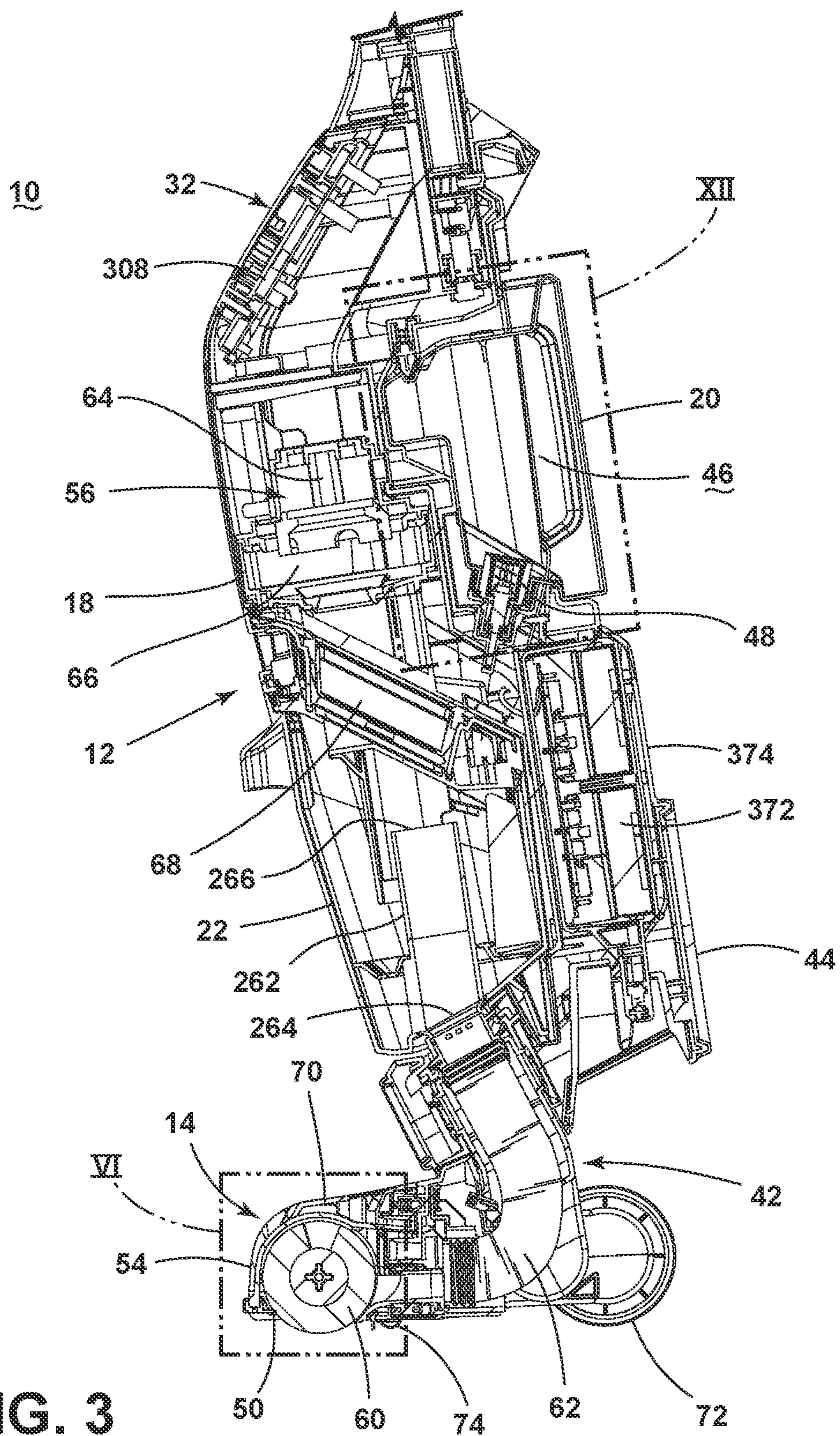


FIG. 3

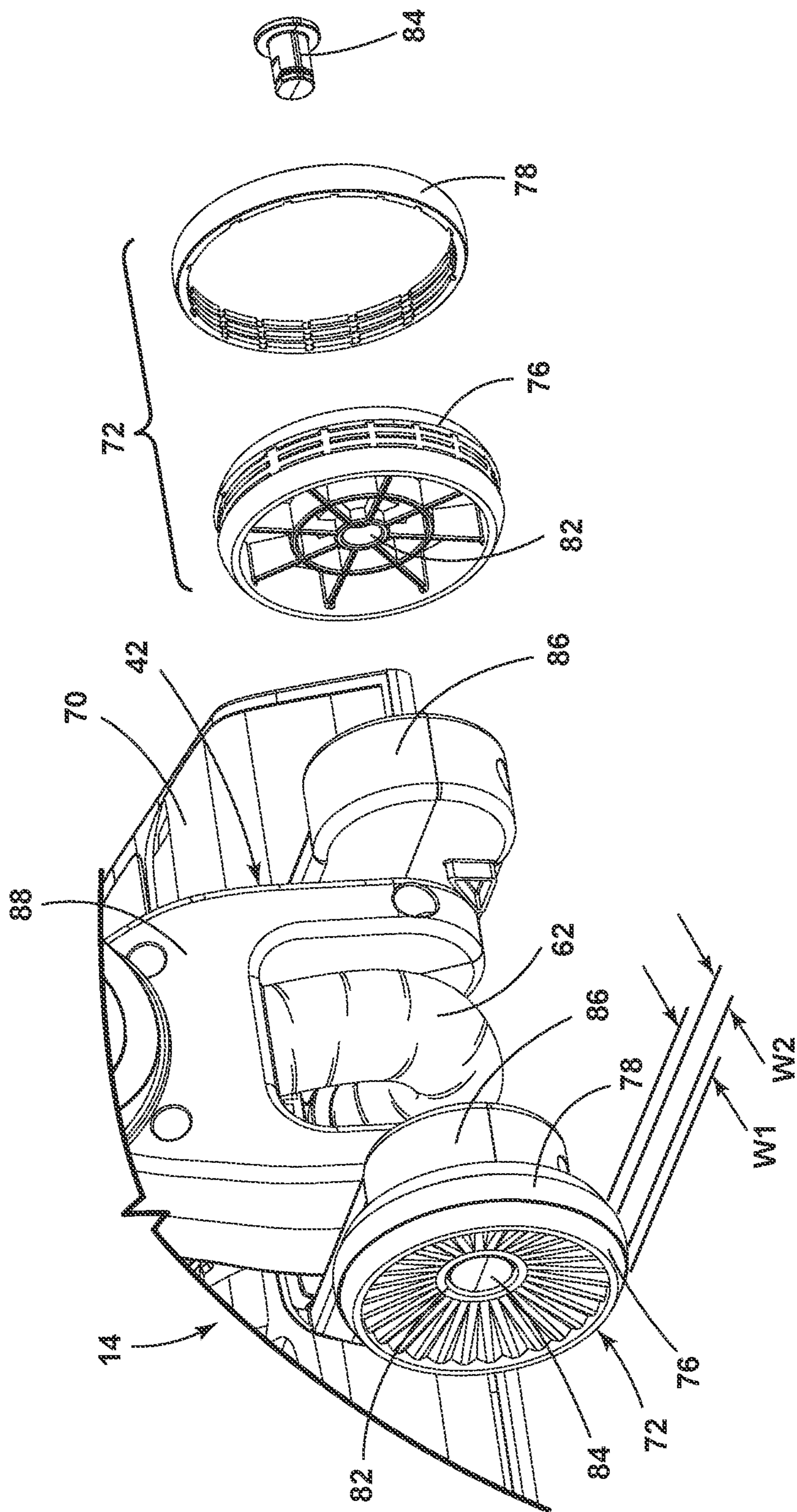


FIG. 4

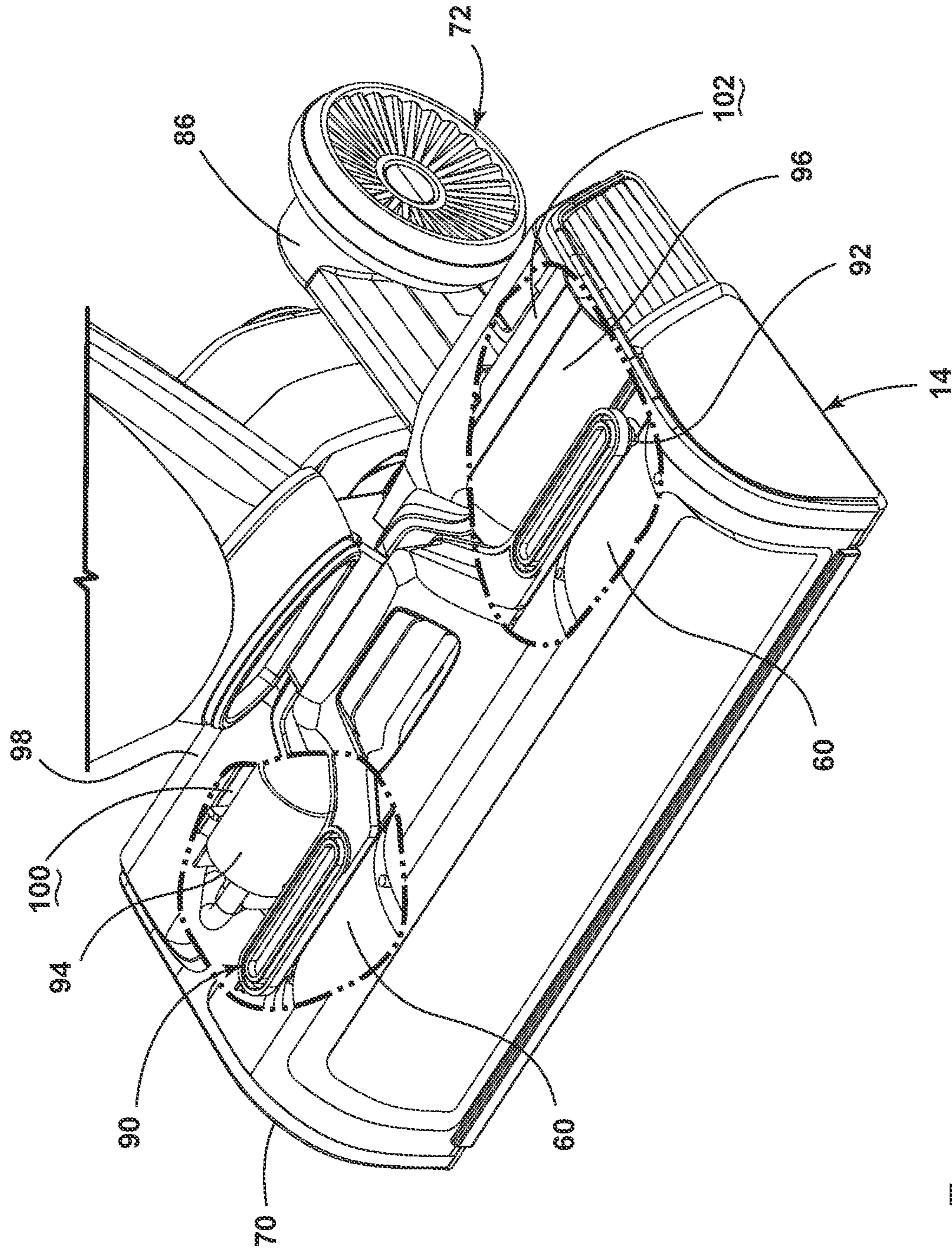


FIG. 5



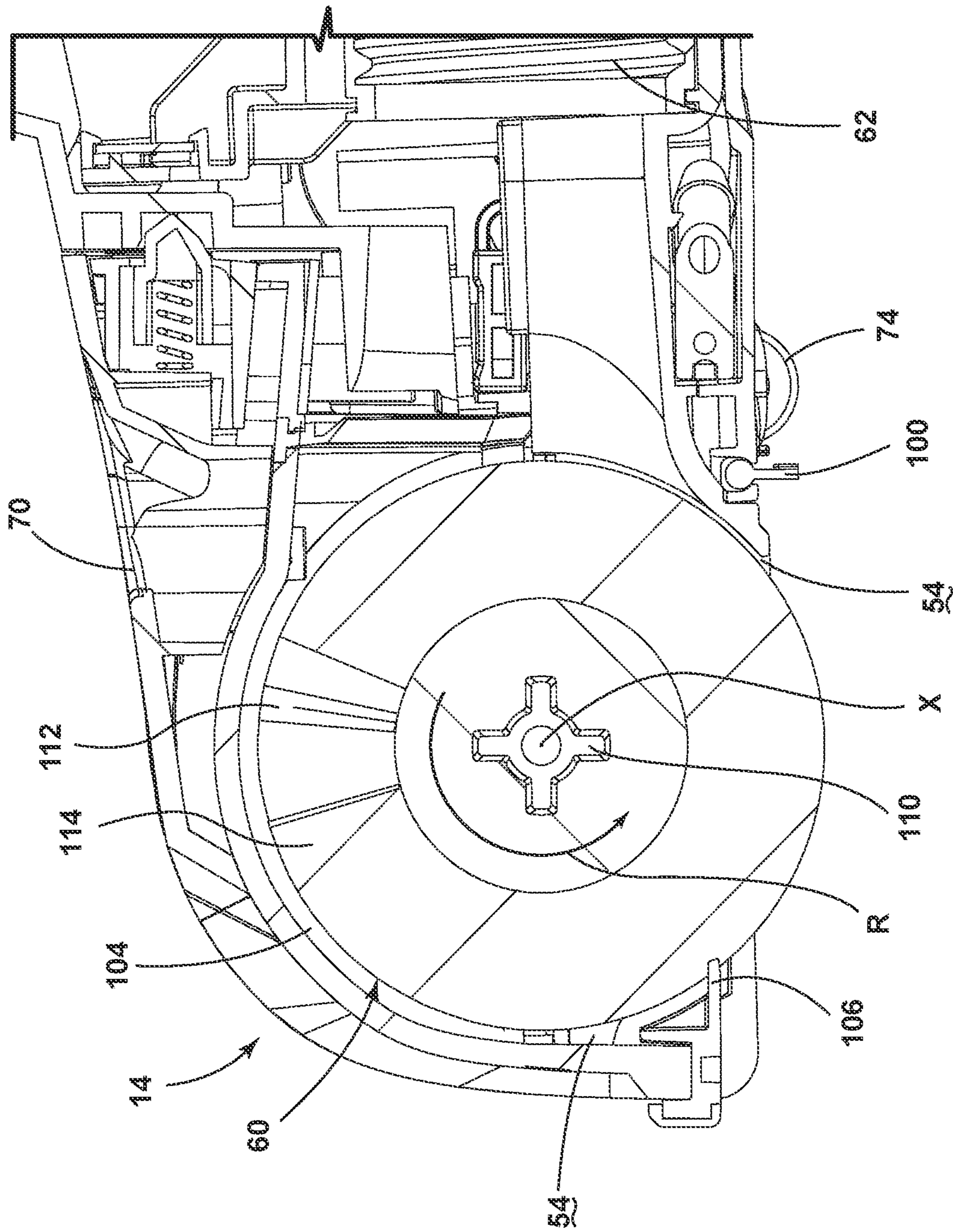


FIG. 6

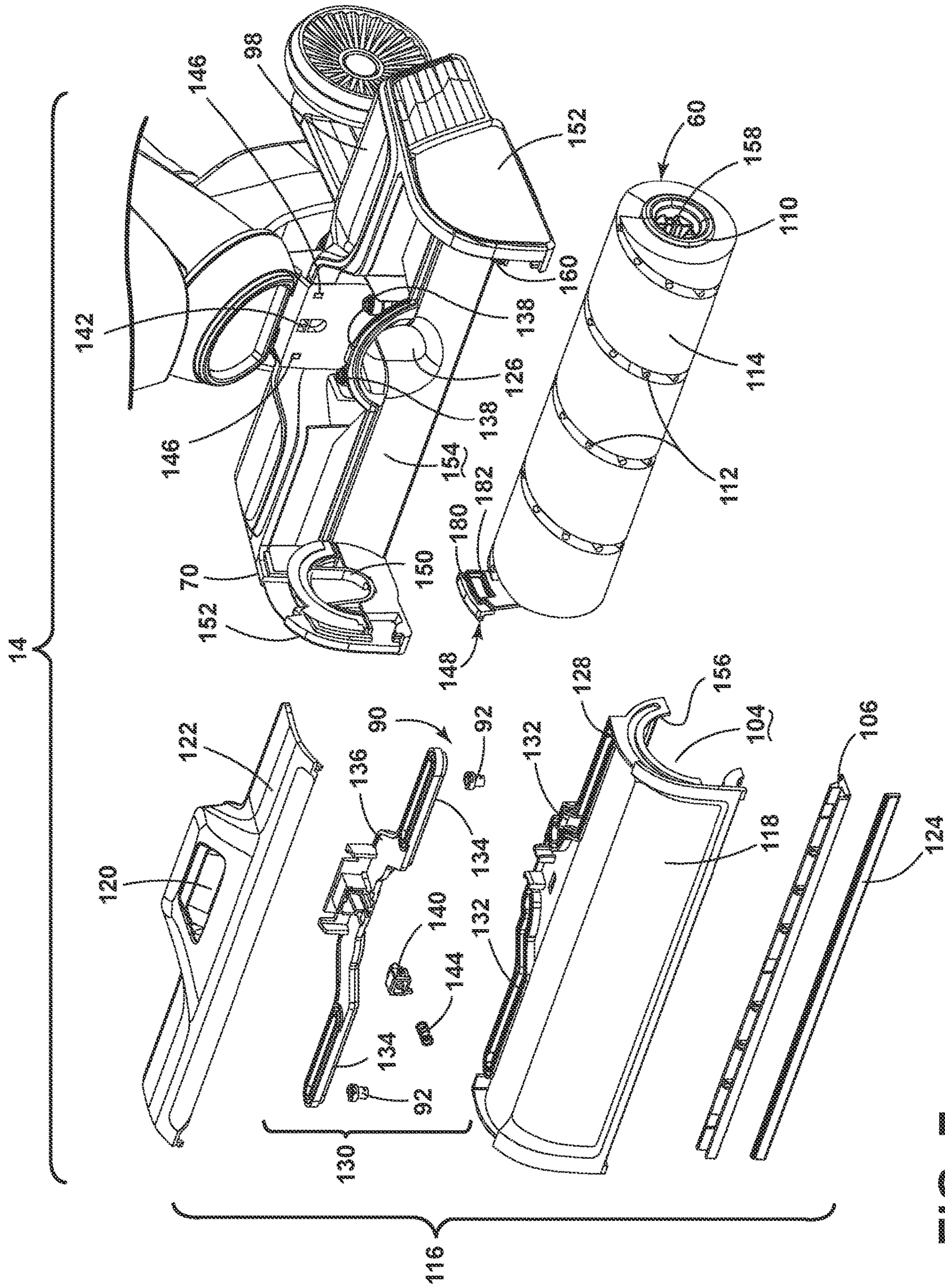


FIG. 7

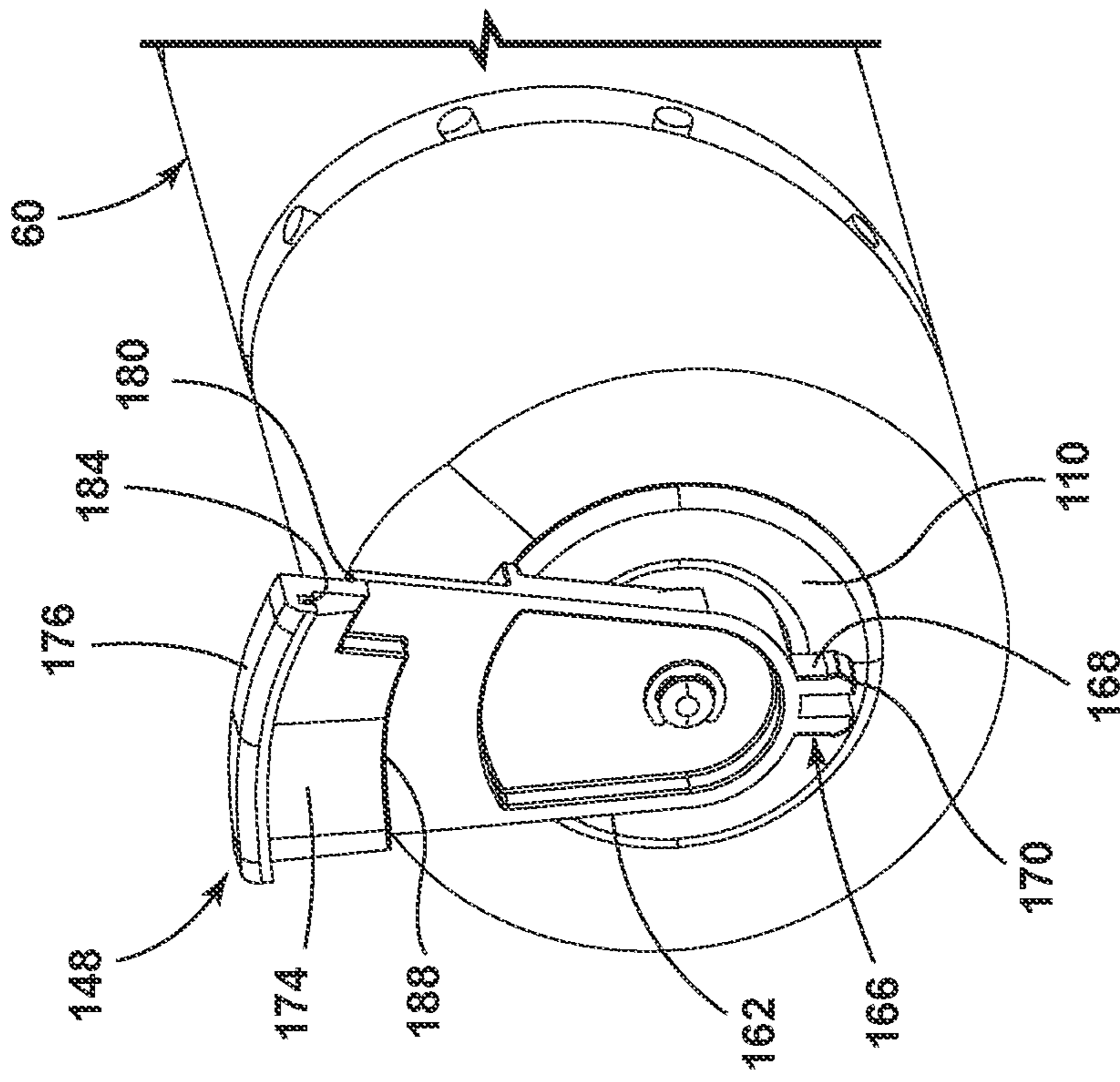


FIG. 8

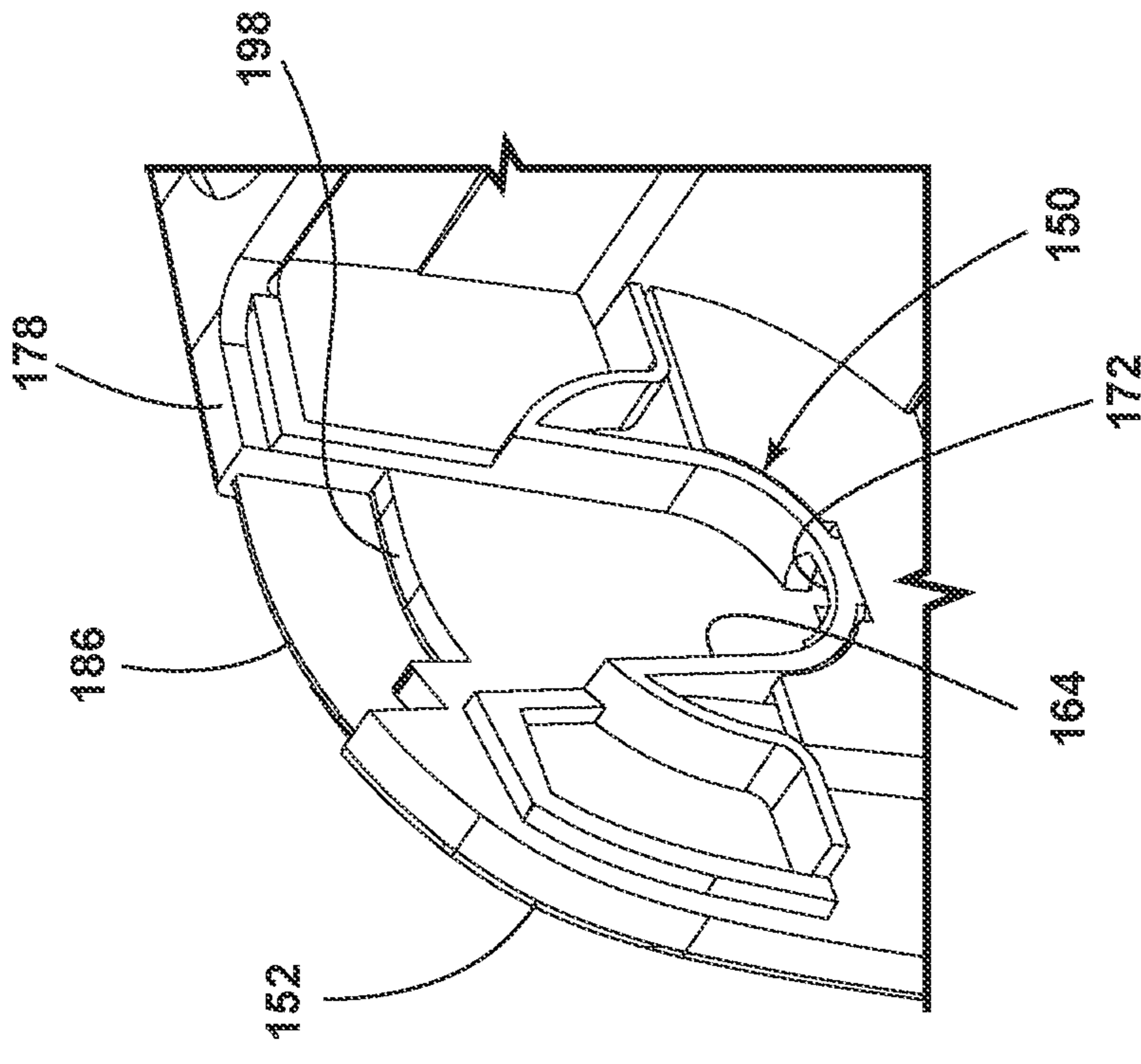


FIG. 9

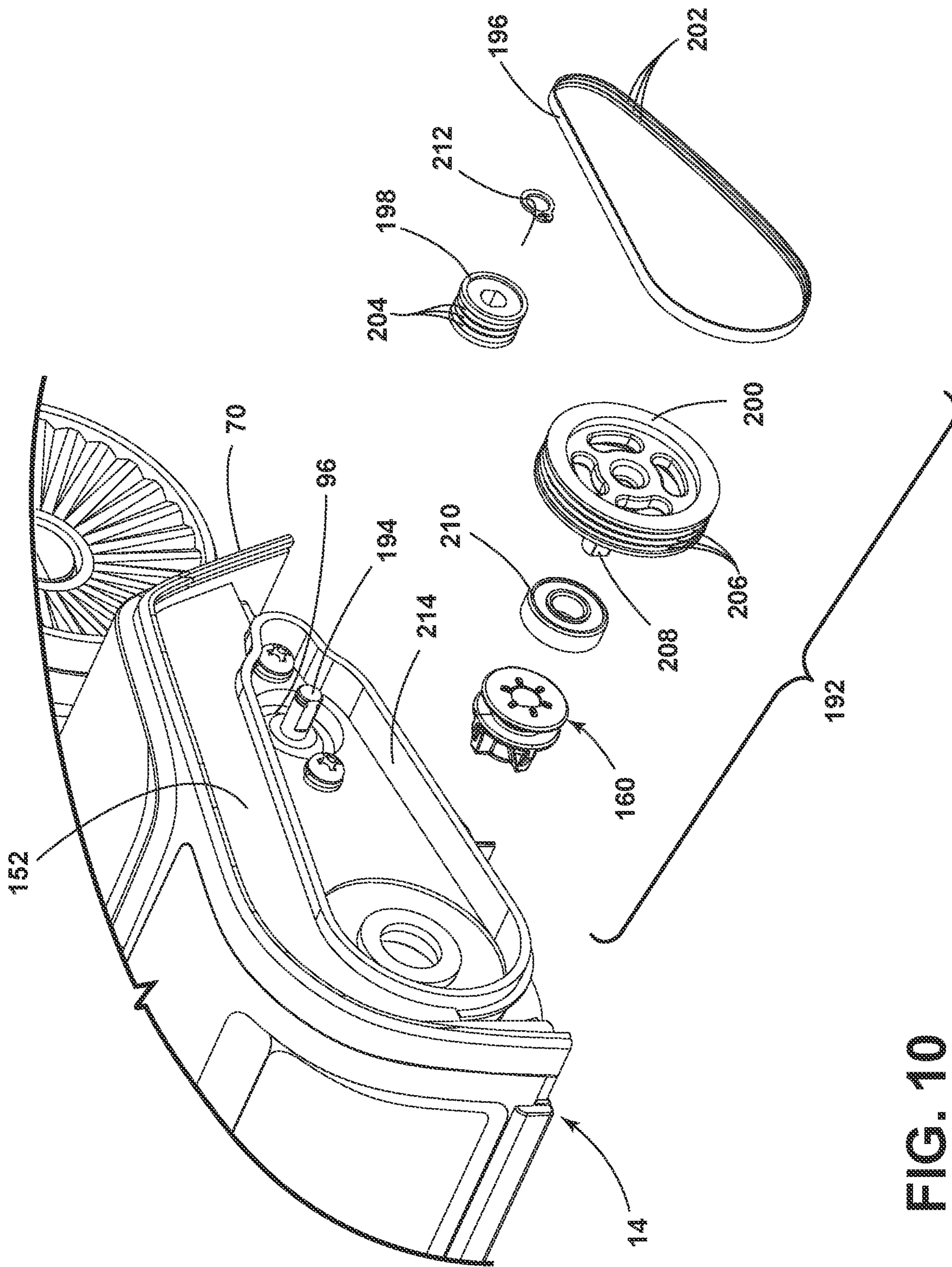


FIG. 10

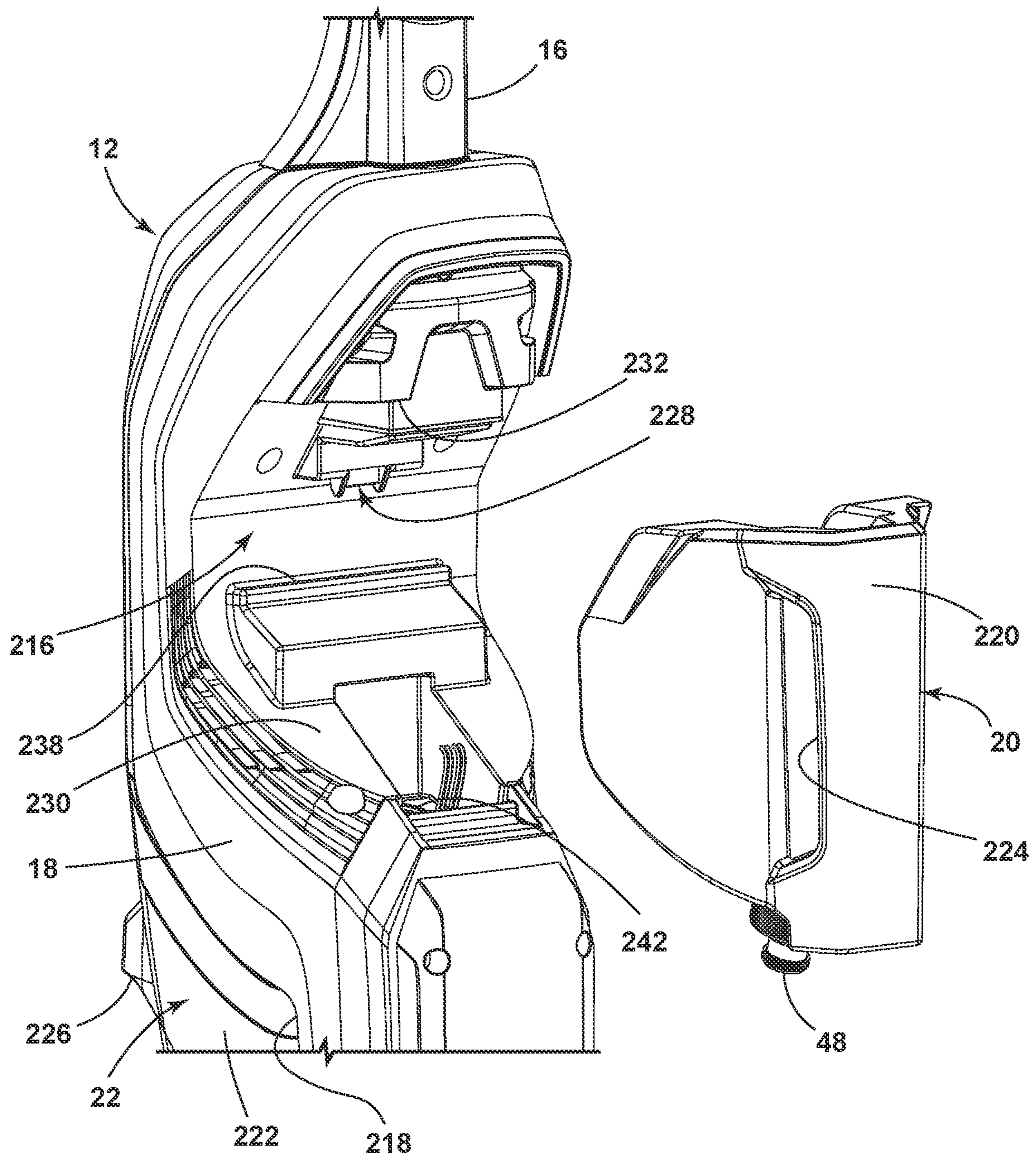


FIG. 11

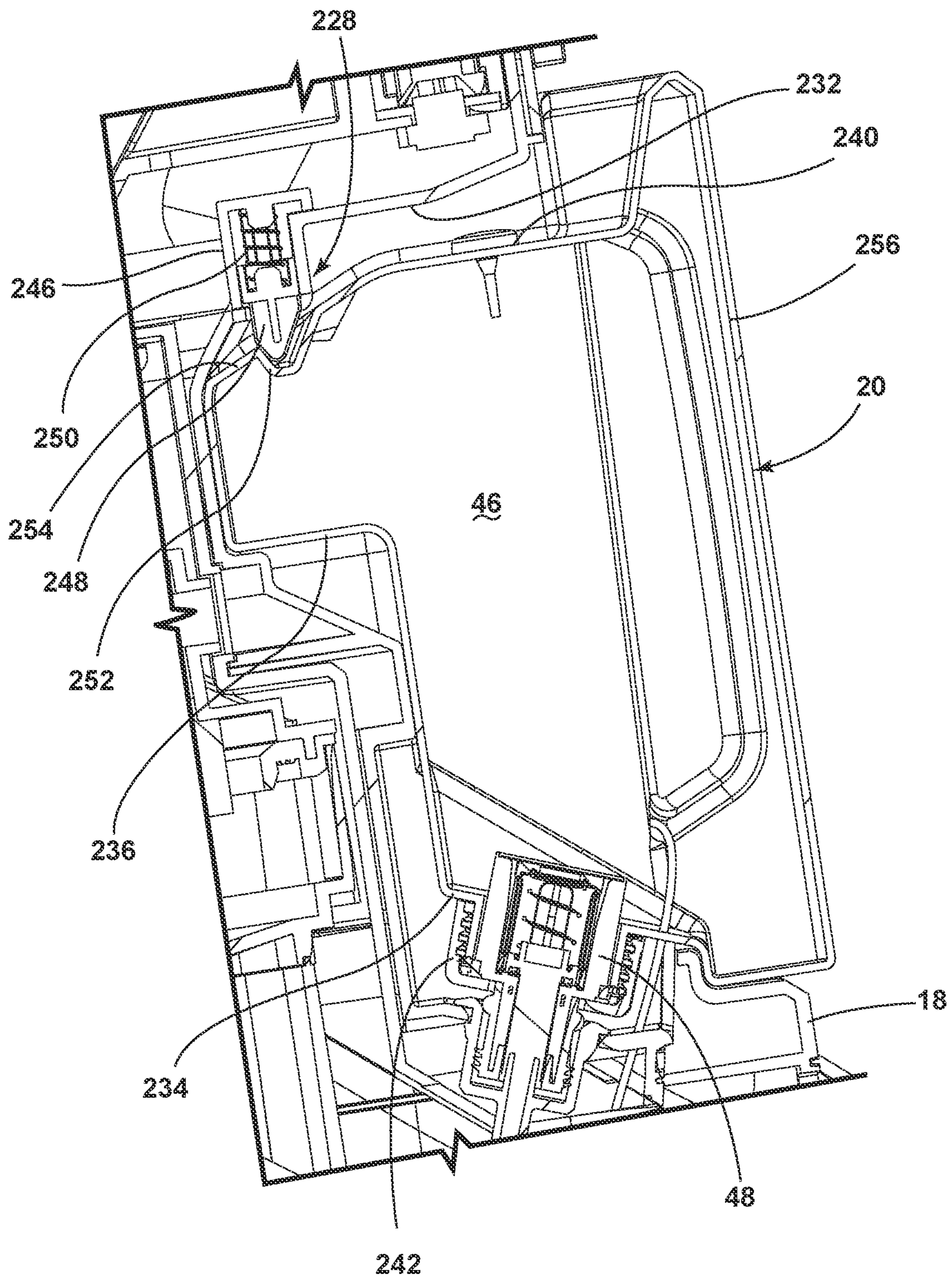


FIG. 12

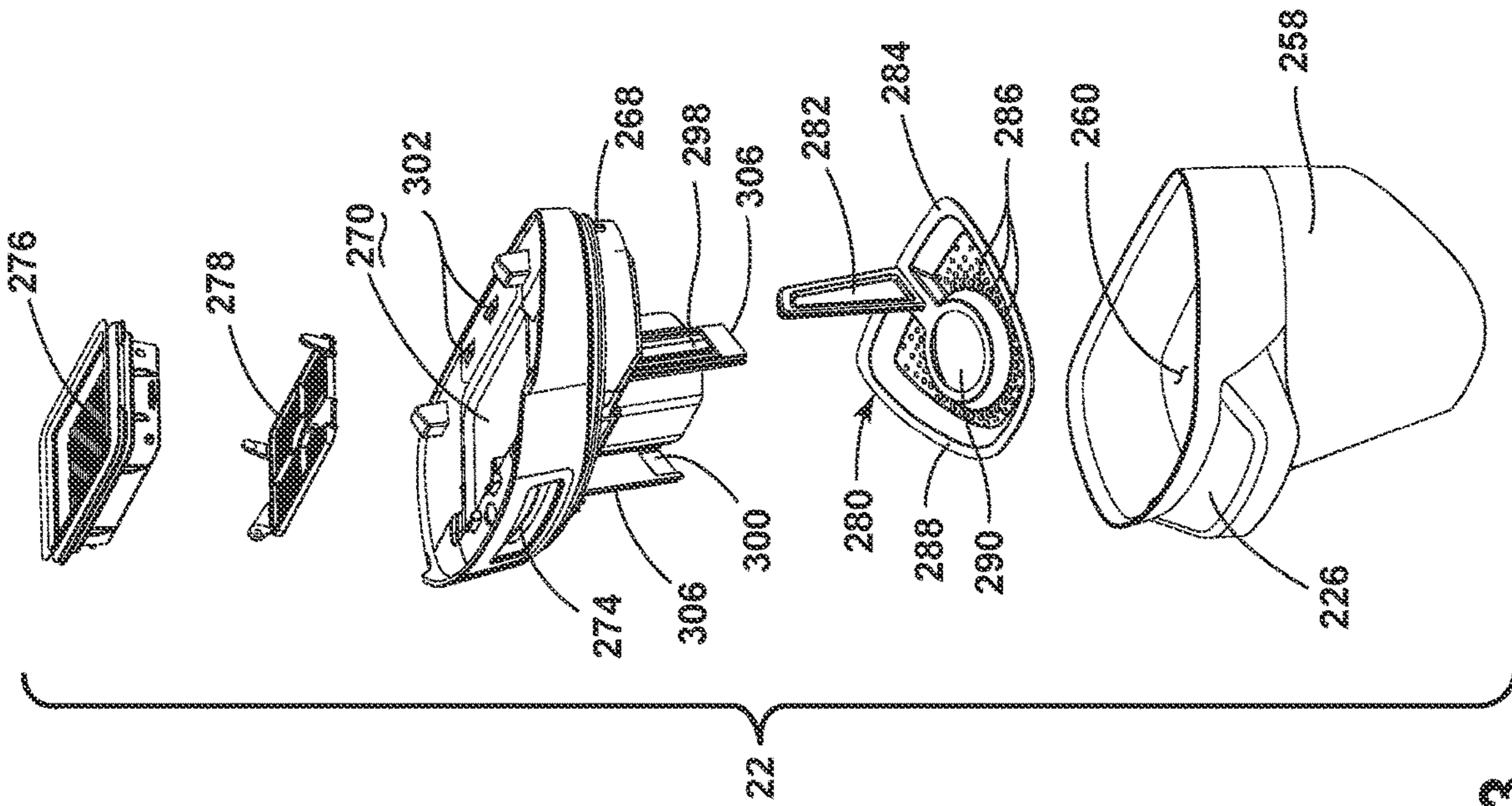


FIG. 13

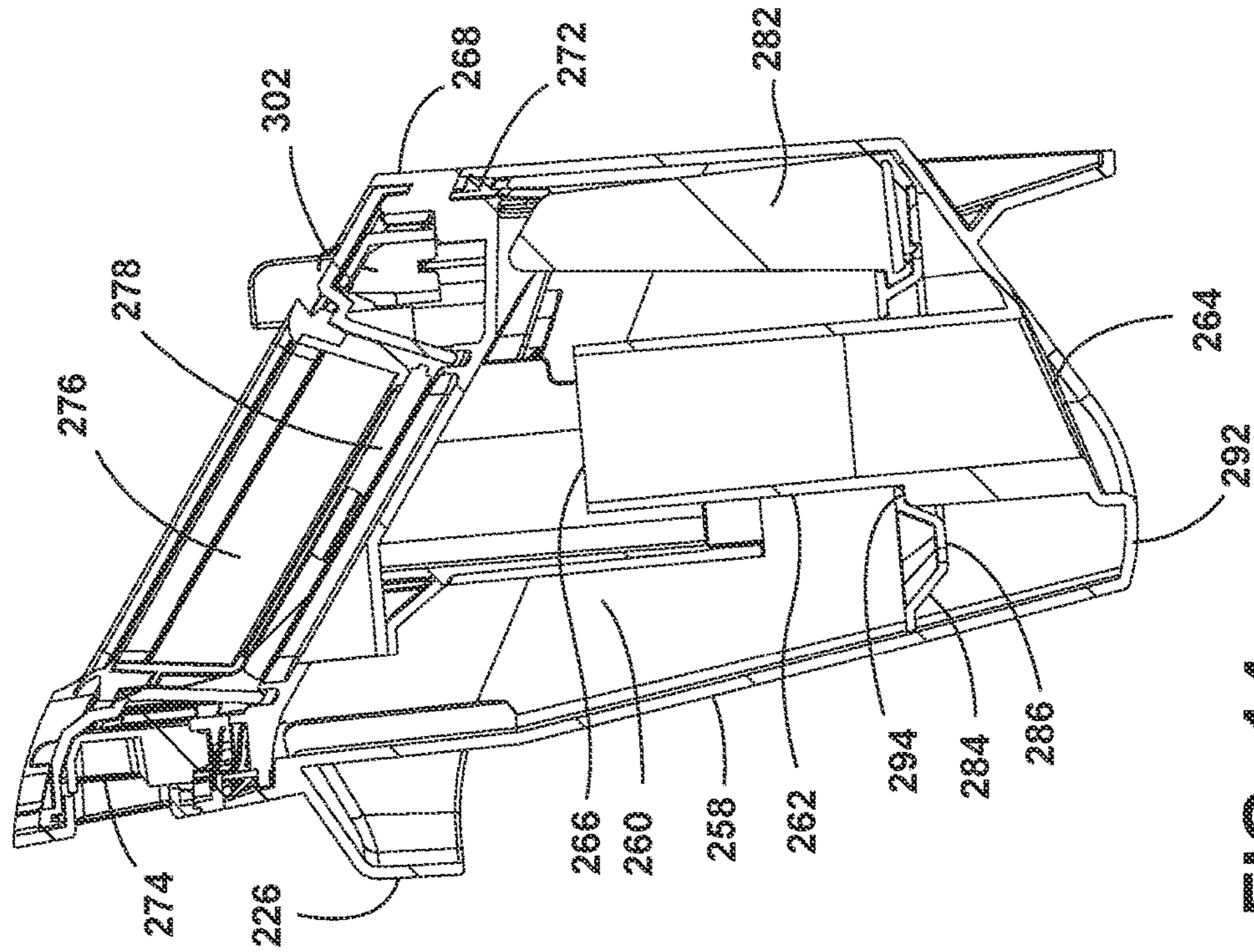


FIG. 14

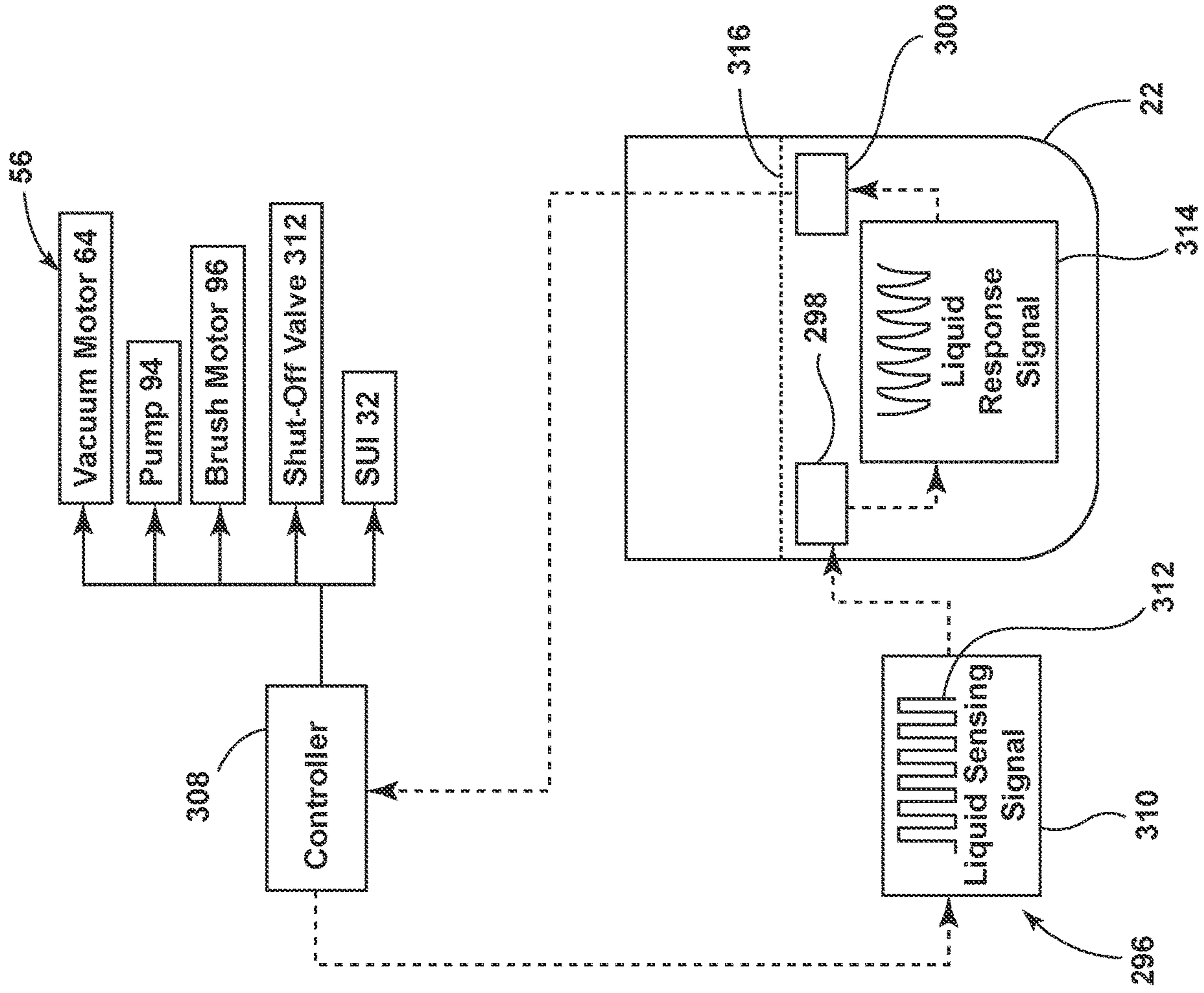


FIG. 15



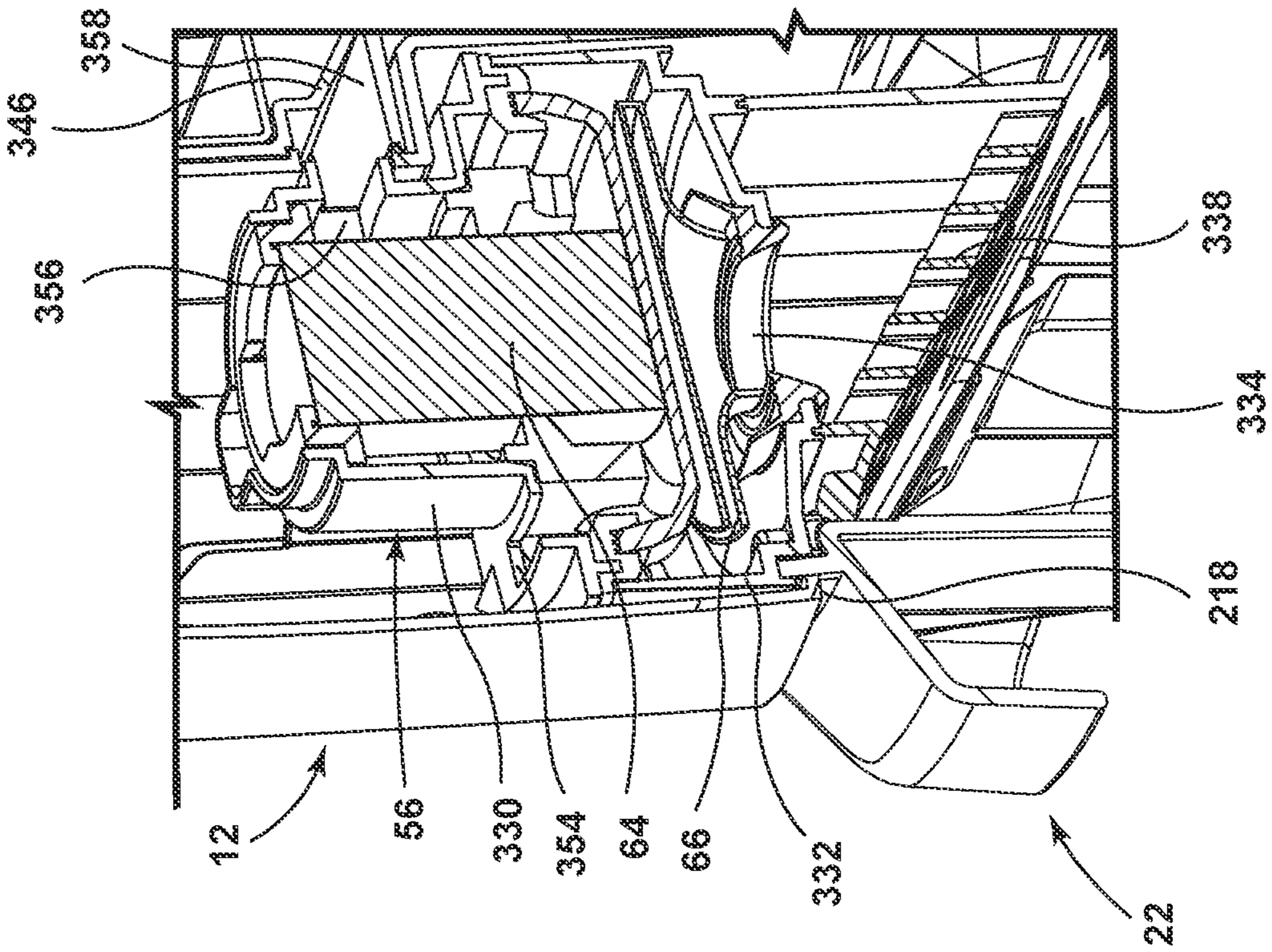


FIG. 16B

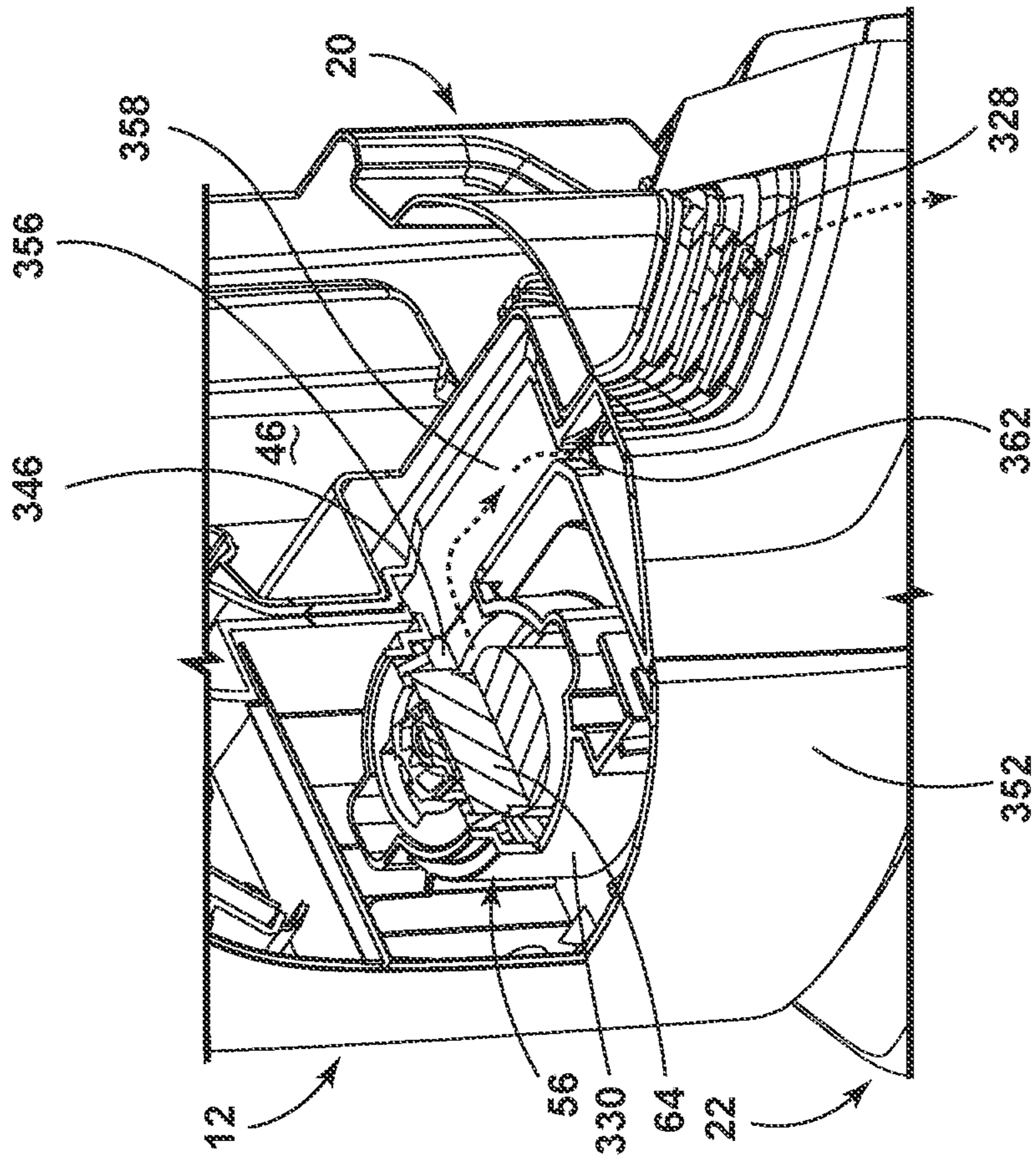


FIG. 16A

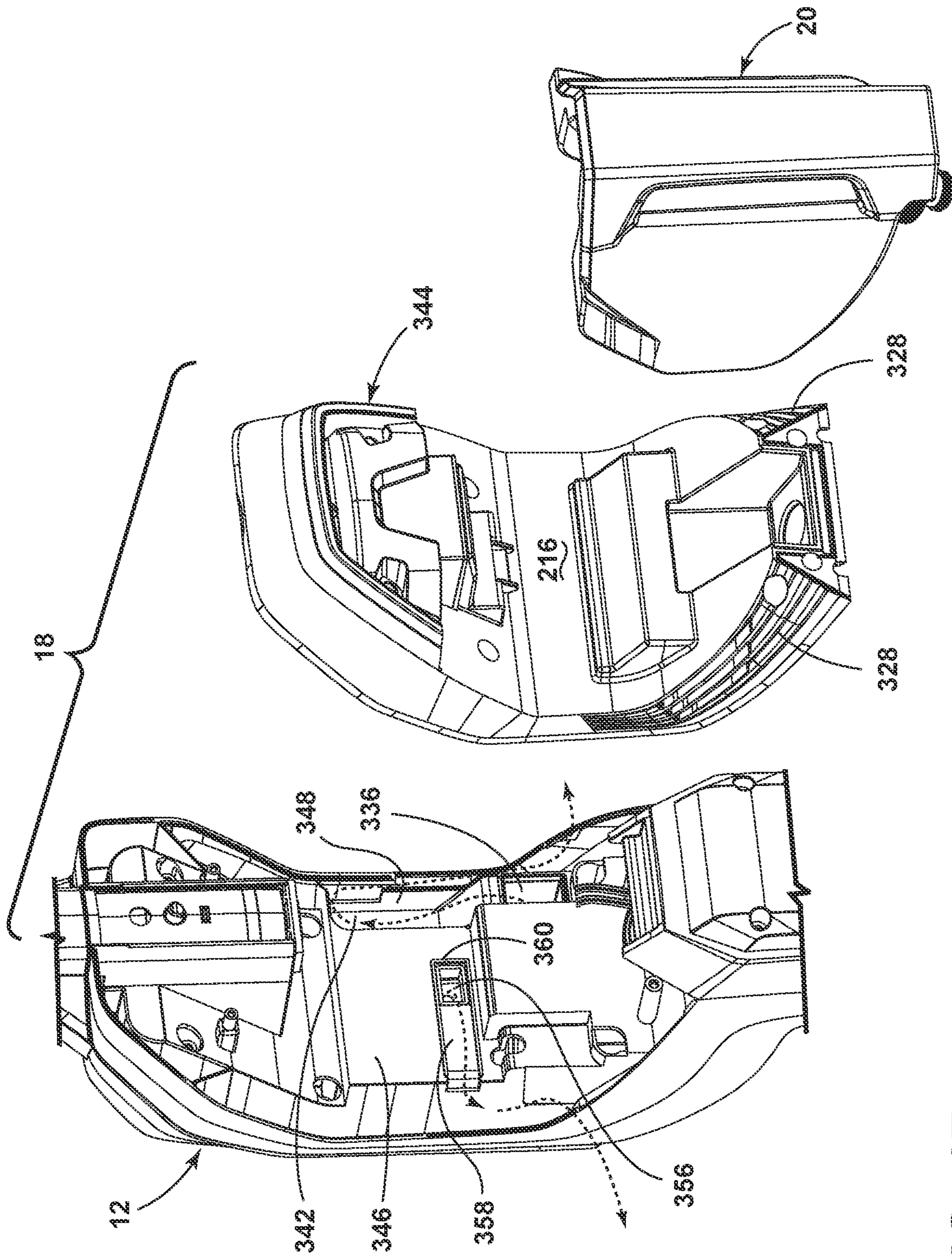


FIG. 17

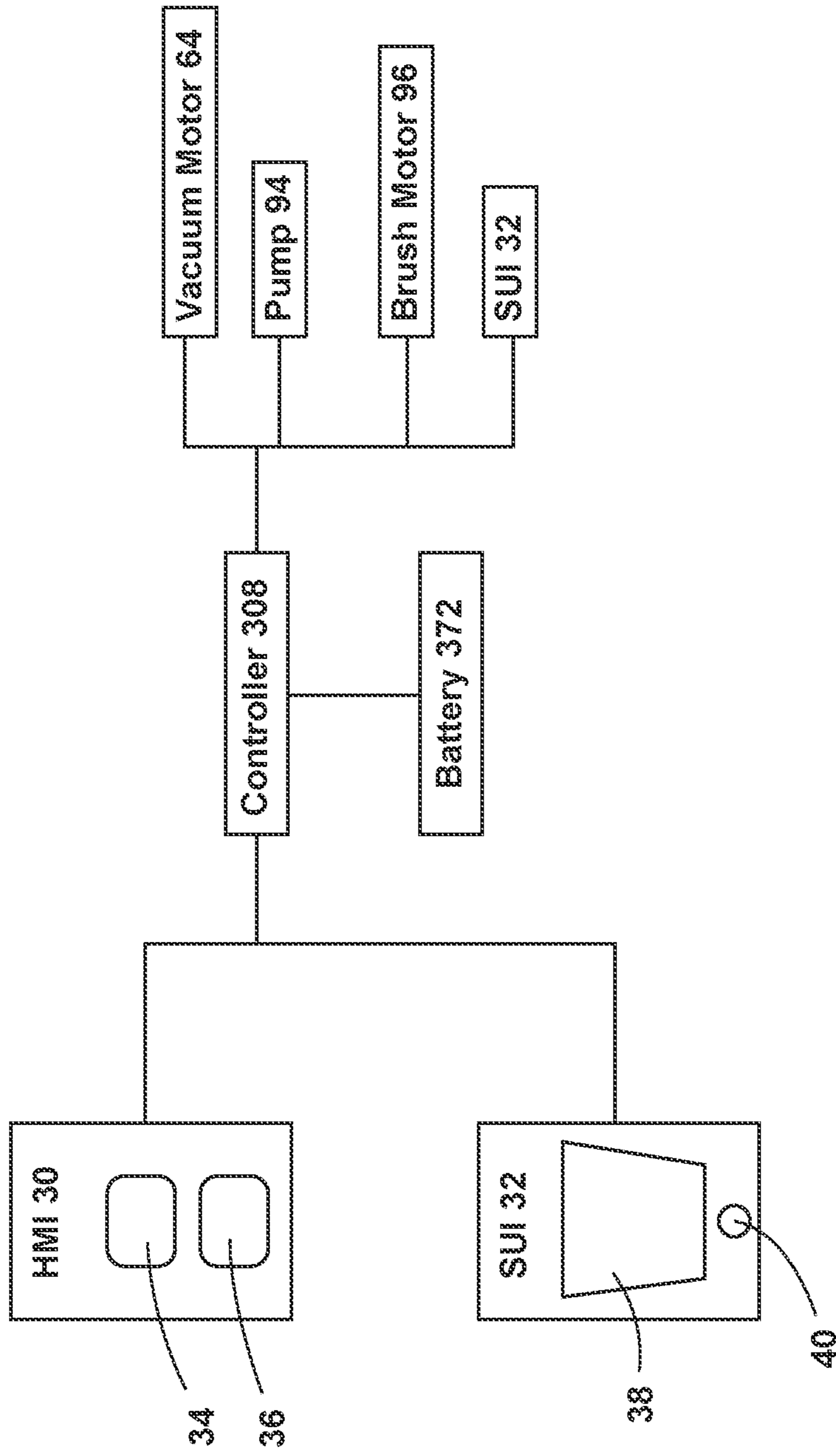


FIG. 18

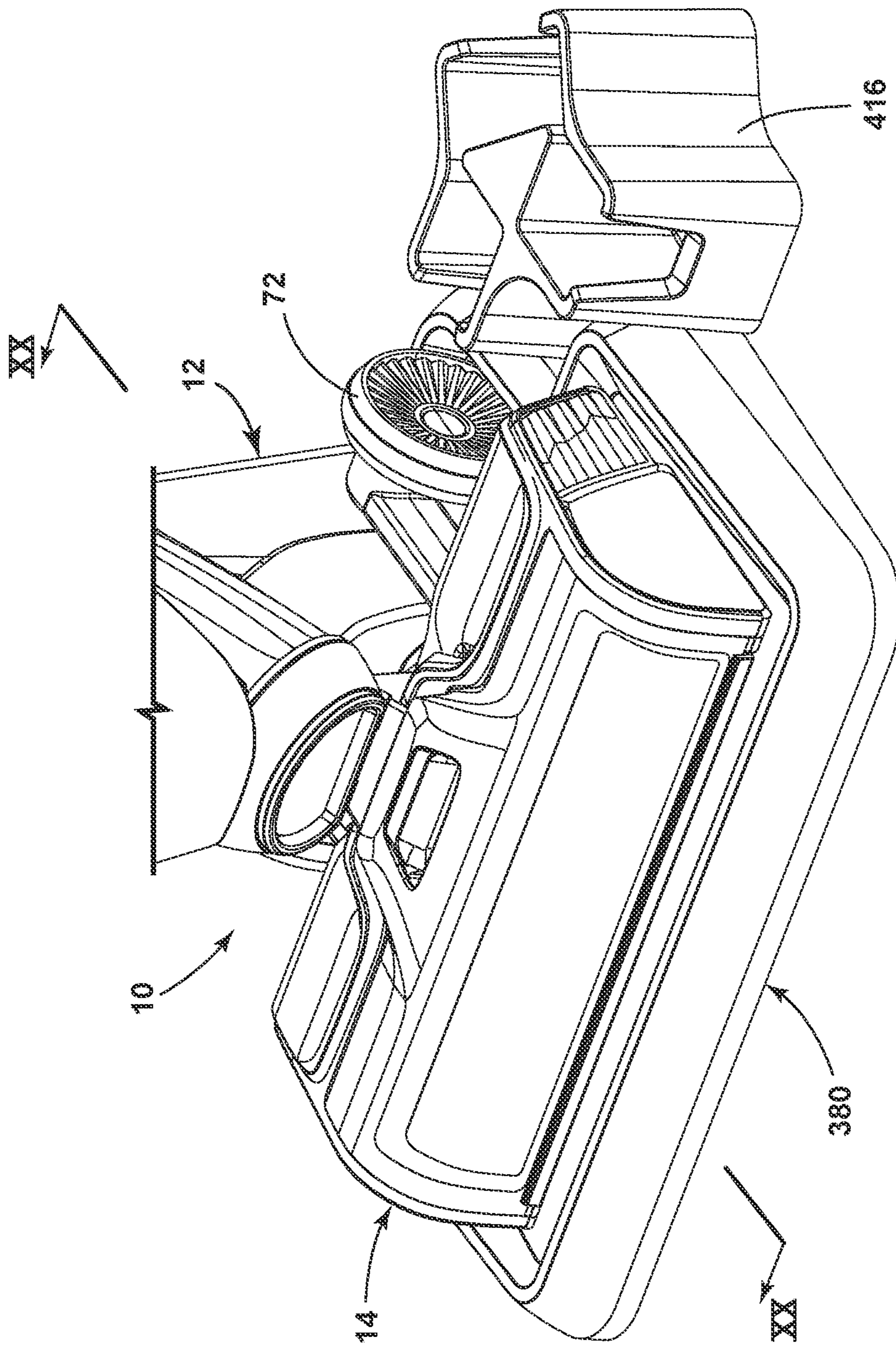


FIG. 19

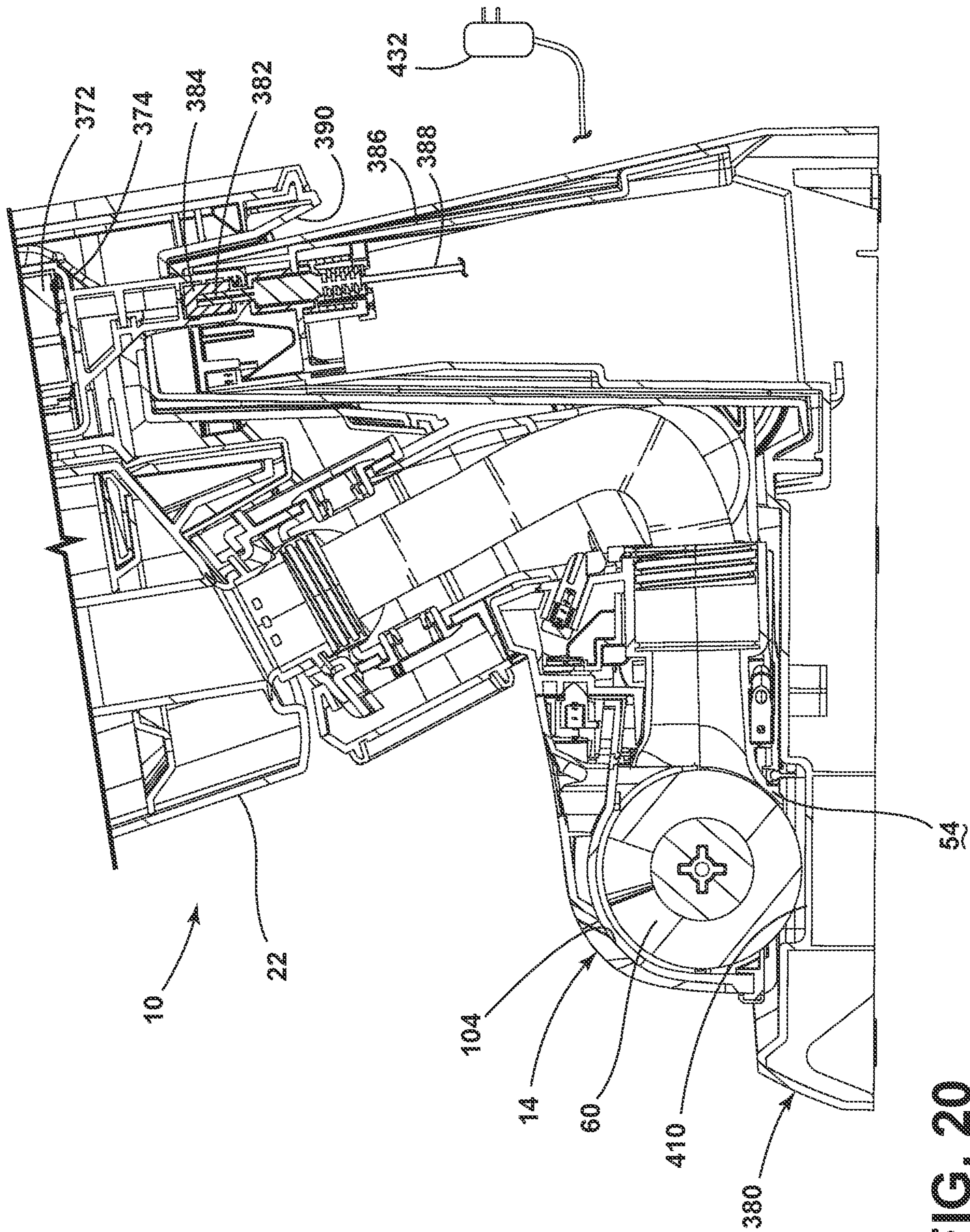


FIG. 20

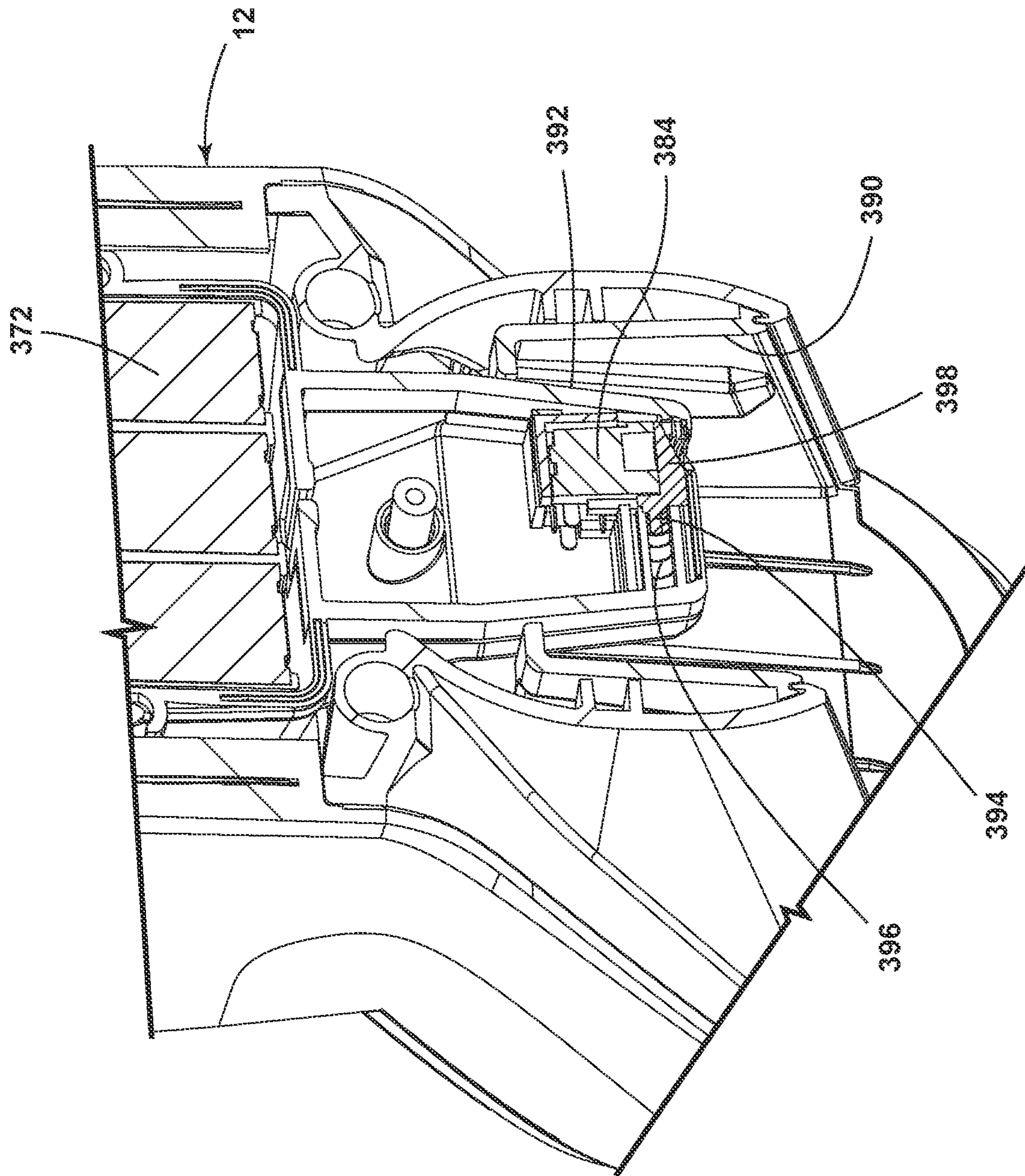


FIG. 21

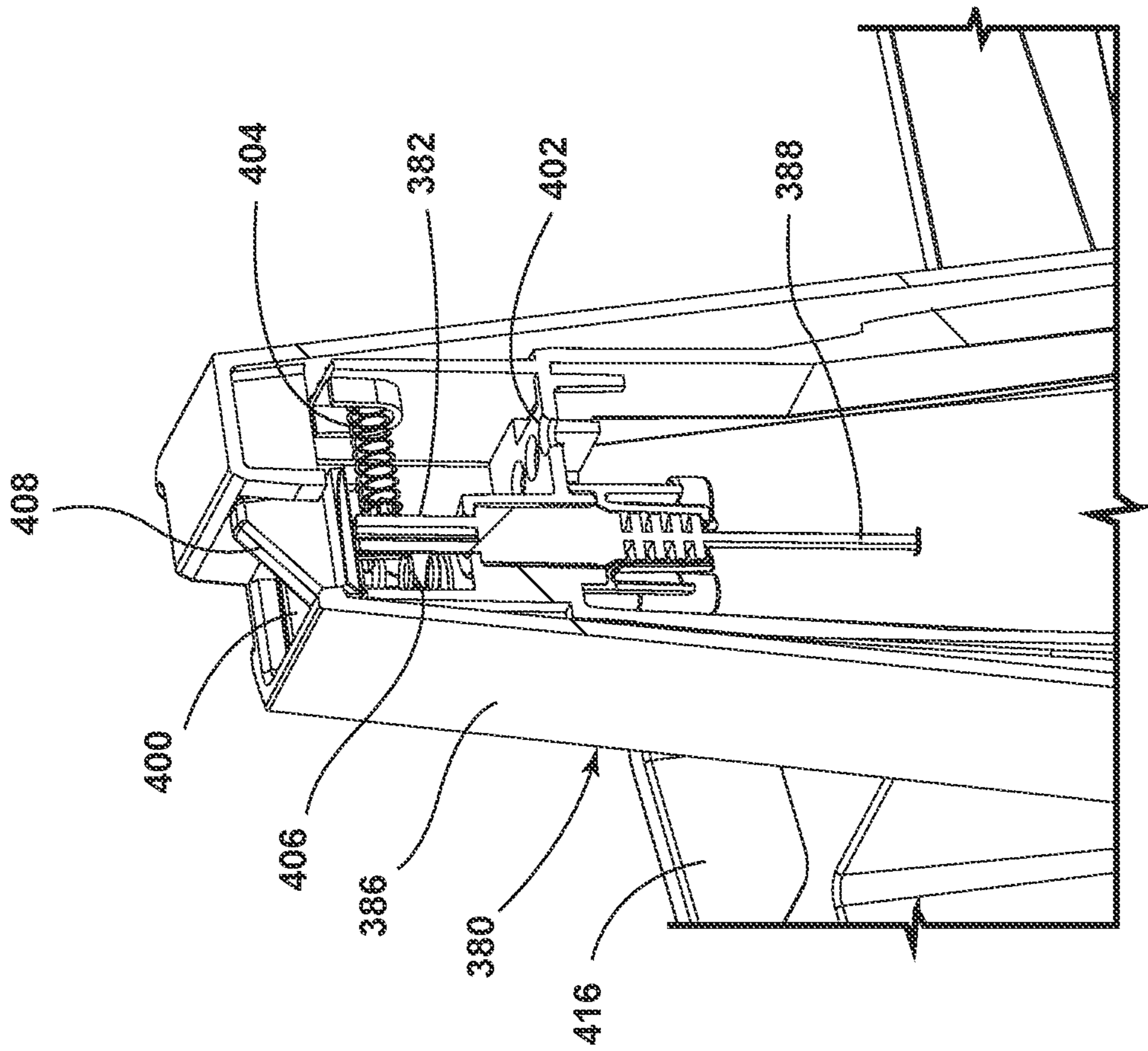


FIG. 22

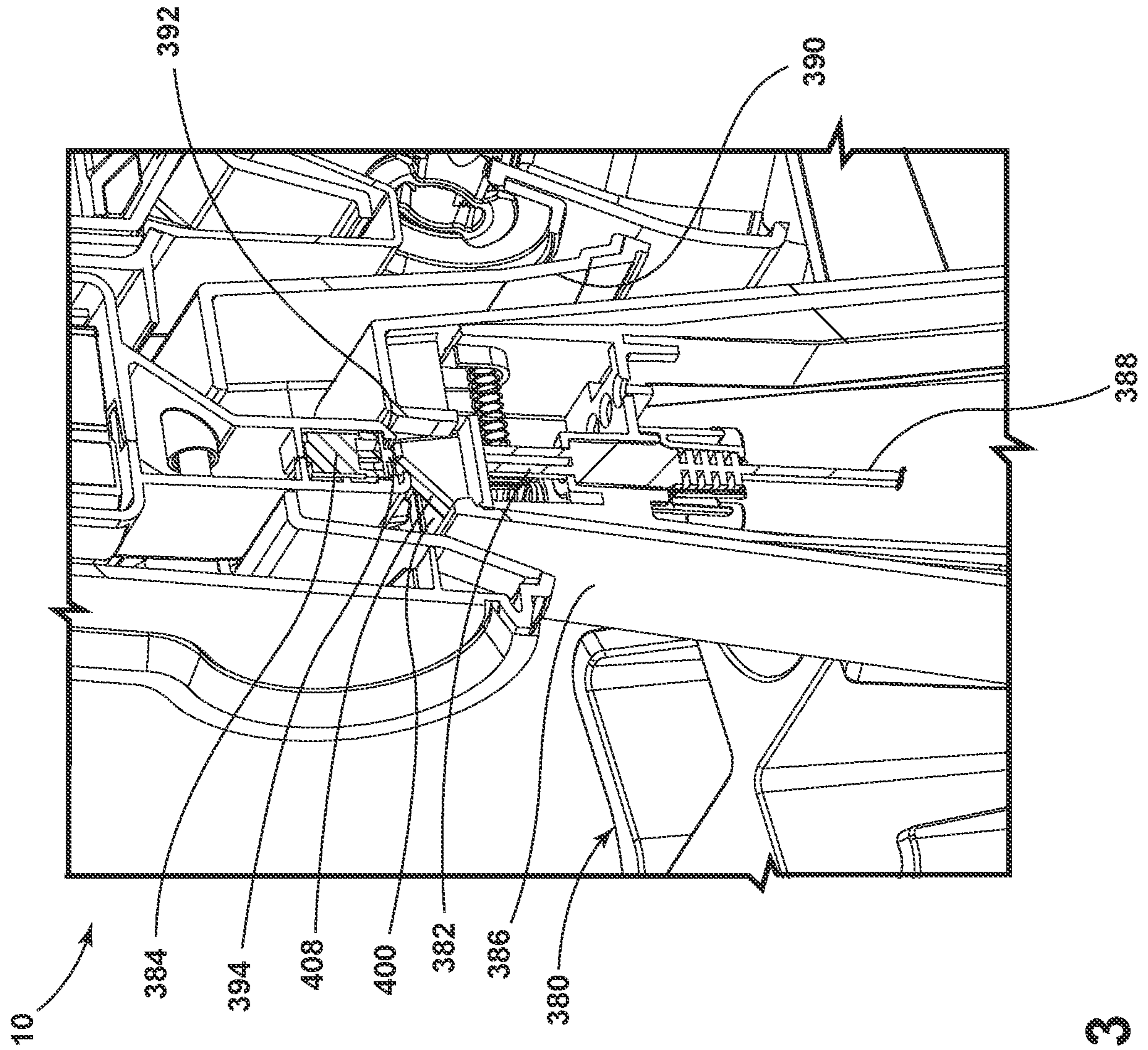


FIG. 23



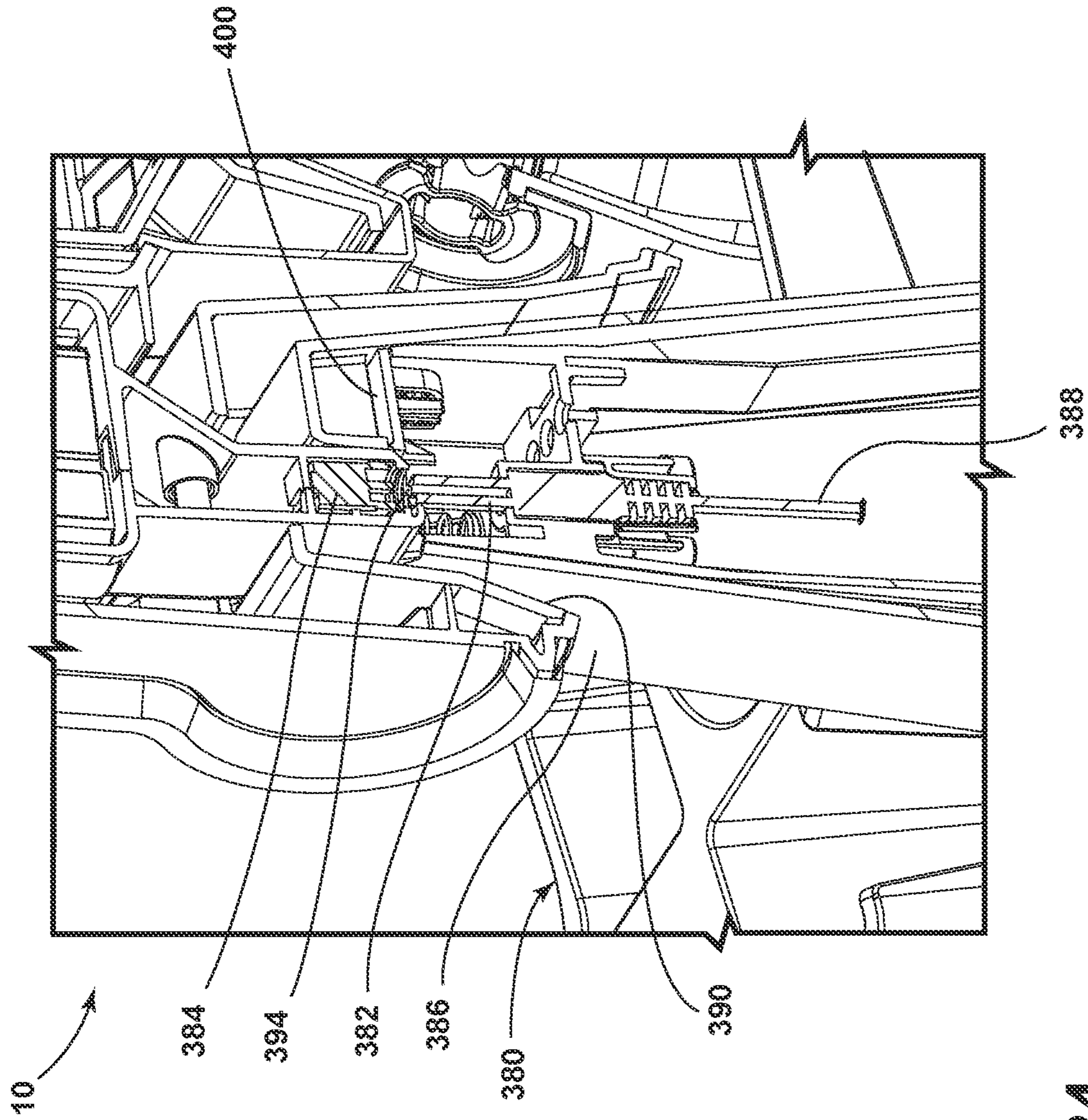


FIG. 24

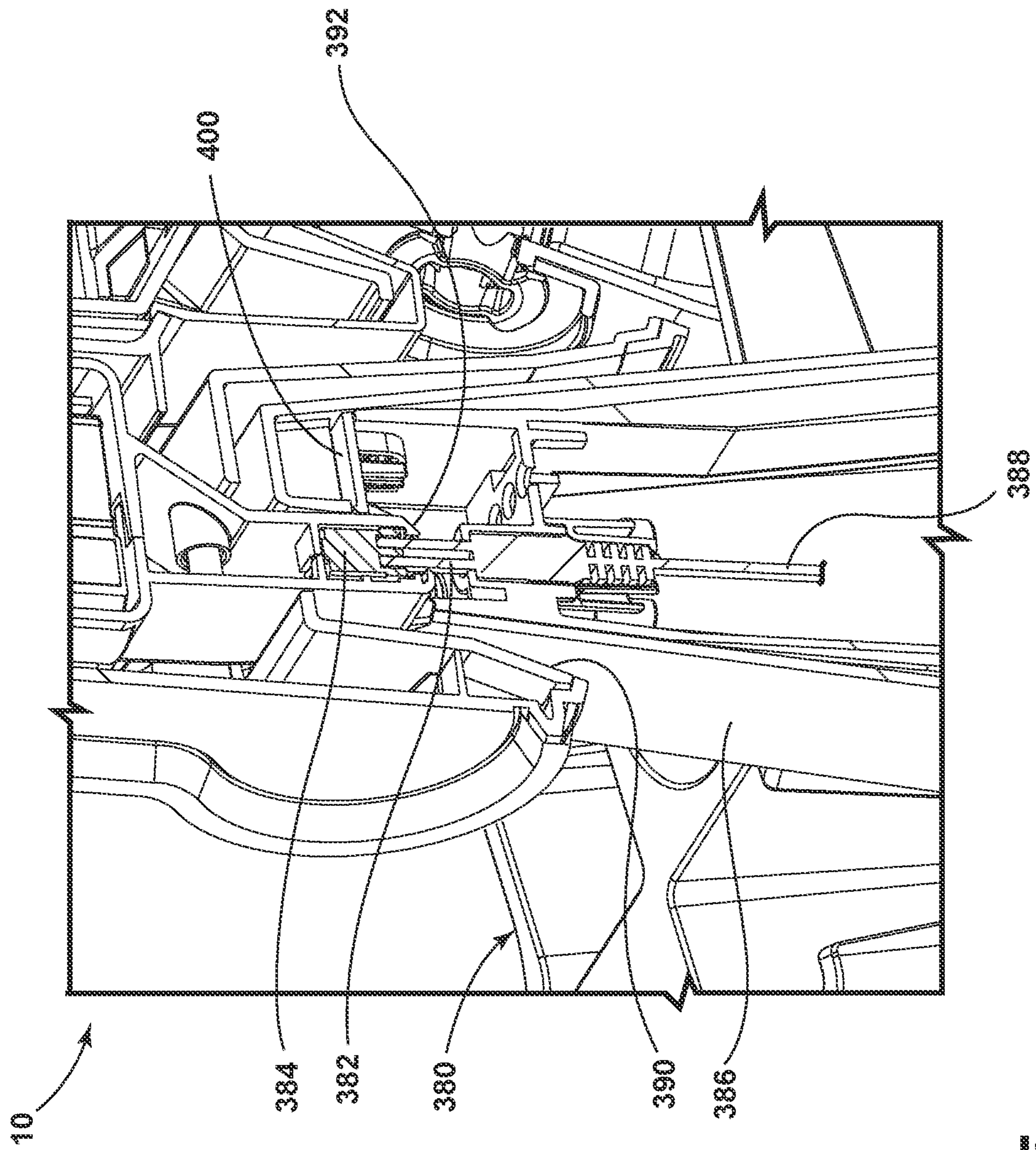


FIG. 25

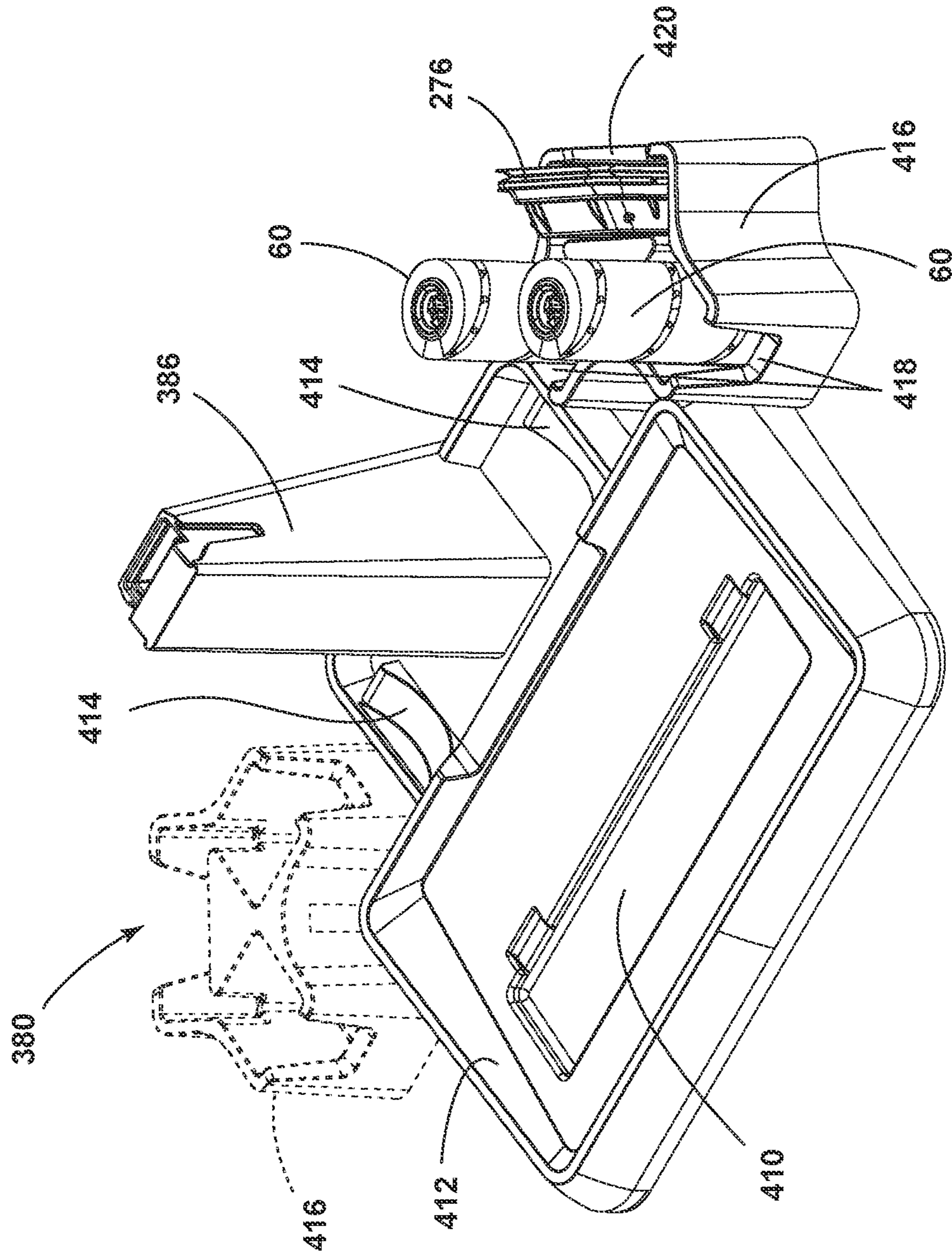


FIG. 26

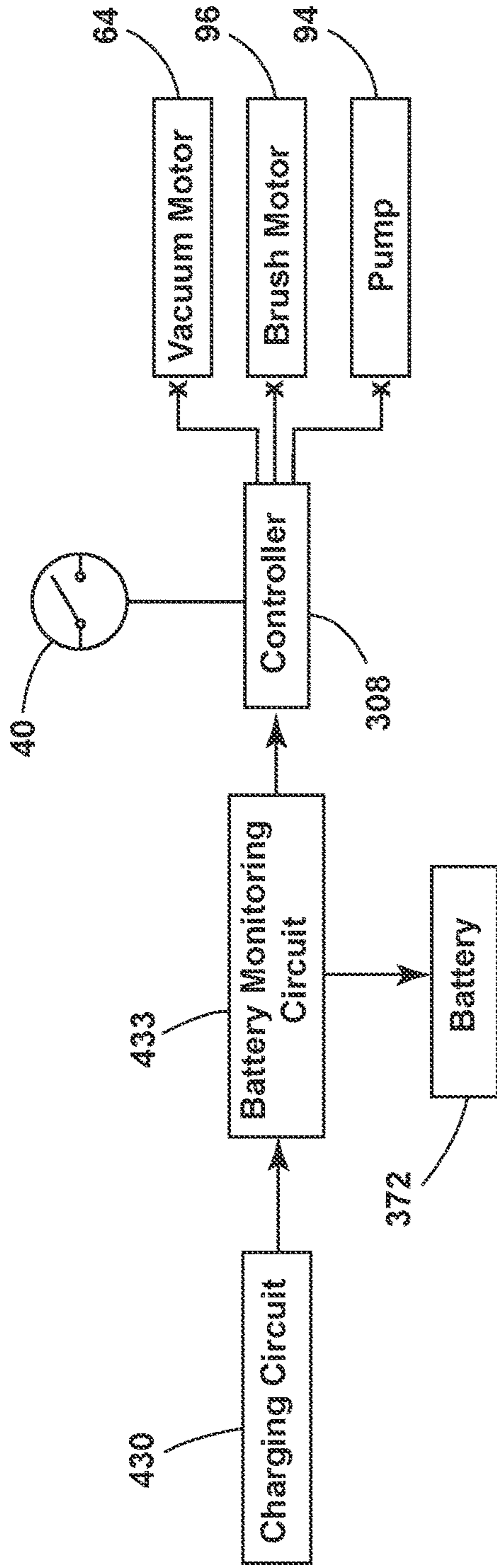


FIG. 27

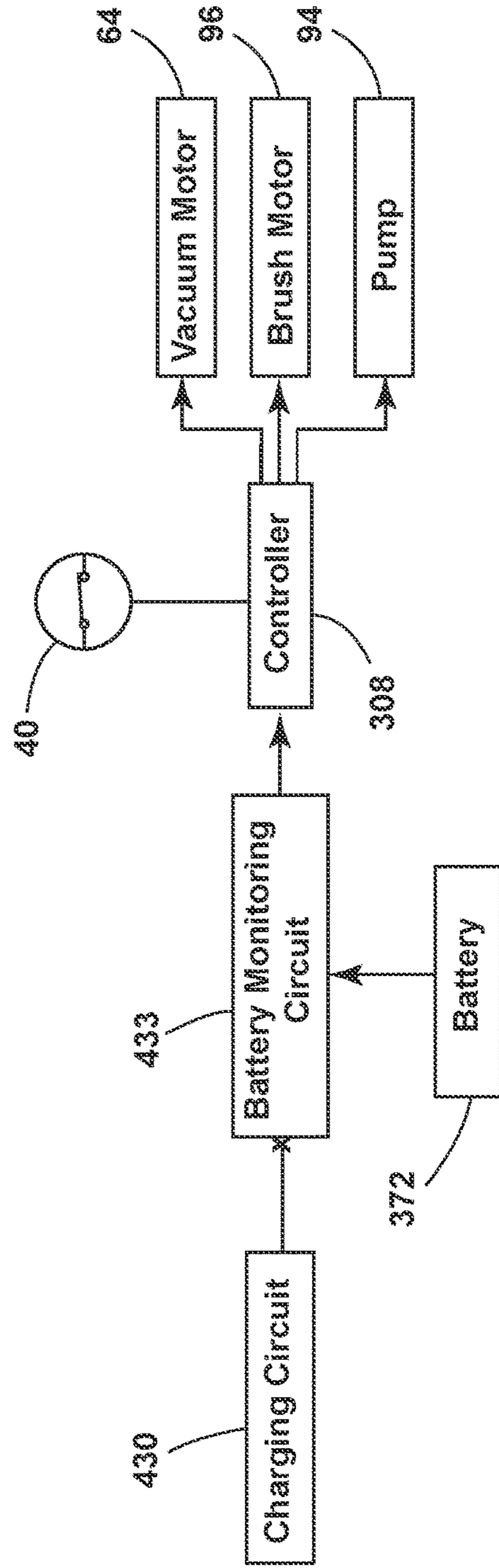


FIG. 28

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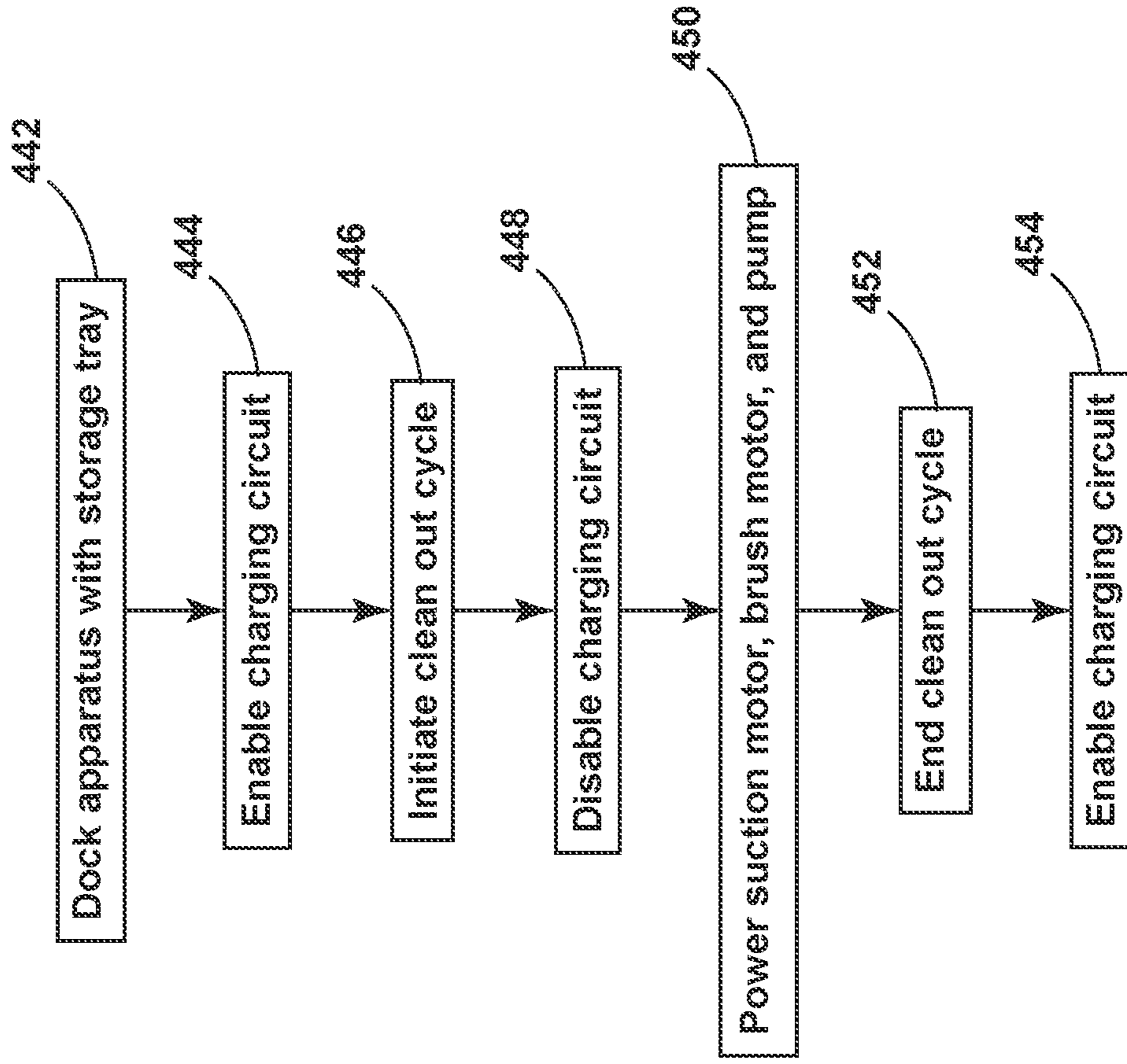


FIG. 29

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**SURFACE CLEANING APPARATUS****CROSS-REFERENCE TO RELATED APPLICATION(S)**

This application is a continuation of U.S. application Ser. No. 17/346,382, filed Jun. 14, 2021, which is a division of U.S. patent application Ser. No. 17/016,824, filed Sep. 10, 2020, which is a continuation of U.S. patent application Ser. No. 16/734,708, filed Jan. 6, 2020, which claims the benefit of U.S. Provisional Patent Application No. 62/789,661, filed Jan. 8, 2019, all of which are incorporated by reference herein in their entirety.

**BACKGROUND**

Multi-surface vacuum cleaners are adapted for cleaning hard floor surfaces such as tile and hardwood and soft floor surfaces such as carpet and upholstery. Some multi-surface vacuum cleaners comprise a fluid delivery system that delivers cleaning fluid to a surface to be cleaned and a fluid recovery system that extracts spent cleaning fluid and debris (which may include dirt, dust, stains, soil, hair, and other debris) from the surface. The fluid delivery system typically includes one or more fluid supply tanks for storing a supply of cleaning fluid, a fluid distributor for applying the cleaning fluid to the surface to be cleaned, and a fluid supply conduit for delivering the cleaning fluid from the fluid supply tank to the fluid distributor. An agitator can be provided for agitating the cleaning fluid on the surface. The fluid recovery system typically includes a recovery tank, a nozzle adjacent the surface to be cleaned and in fluid communication with the recovery tank through a working air conduit, and a source of suction in fluid communication with the working air conduit to draw the cleaning fluid from the surface to be cleaned and through the nozzle and the working air conduit to the recovery tank. Other multi-surface cleaning apparatuses include “dry” vacuum cleaners which can clean different surface types, but do not dispense or recover liquid.

**BRIEF SUMMARY**

A surface cleaning apparatus is provided herein. In certain embodiments, the surface cleaning apparatus is a multi-surface wet vacuum cleaner that can be used to clean hard floor surfaces such as tile and hardwood and soft floor surfaces such as carpet.

According to one aspect of the disclosure, a floor cleaning system includes a surface cleaning apparatus having an upright body comprising a handle and a frame, a base coupled with the upright body and adapted for movement across a surface to be cleaned, a moveable joint assembly mounting the base to the upright body, wherein the upright body is pivotable via the joint assembly between an upright storage position and a reclined use position, a fluid delivery system comprising a supply tank, a pump, and a fluid distributor, a recovery system comprising a recovery pathway, a recovery tank, a suction nozzle, and a vacuum motor, a brushroll within the recovery pathway of the recovery system, a brushroll motor operably coupled to the brushroll for rotating the brushroll, wherein the recovery system is configured to extract fluid and debris from the brushroll, transport fluid and debris through the recovery pathway and deposit into the recovery tank, a rechargeable battery configured to selectively power the pump, the brushroll motor, and the vacuum motor, at least one controller configured to initiate an unattended automatic cleanout mode of operation

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in response to a user selection, during which the pump, the brushroll motor, and the vacuum motor are energized, a battery charging circuit for controlling the recharging of the rechargeable battery, and a storage tray configured to dock the surface cleaning apparatus in the upright storage position, wherein the at least one controller is configured to detect that the surface cleaning apparatus is docked with the storage tray and initiate the unattended automatic cleanout mode of operation in response to a user selection, and wherein the battery charging circuit is disabled following the initiation of the unattended automatic cleanout mode of operation.

According to another aspect of the disclosure, a surface cleaning system includes a surface cleaning apparatus having an upright body comprising a handle and a frame, a base coupled with the upright body and adapted for movement across a surface to be cleaned, a moveable joint assembly mounting the base to the upright body, wherein the upright body is pivotable via the joint assembly between an upright storage position and a reclined use position, a fluid delivery system comprising a supply tank removable from the frame, a pump, and a fluid distributor, a recovery system comprising a recovery pathway, a recovery tank, a suction nozzle, and a vacuum motor, a brushroll within the recovery pathway of the recovery system, a brushroll motor operably coupled to the brushroll for rotating the brushroll, wherein the suction nozzle is configured to extract fluid and debris from the brushroll, a rechargeable battery, operably connected to at least one controller, configured to selectively energize the pump, the vacuum motor, and the brushroll motor, a self-cleaning mode input control disposed on the upright body operably connected to at least one controller, wherein the at least one controller is configured to execute an unattended automatic cleanout mode of operation during which each one of the pump, the brushroll motor, and the vacuum motor are energized, and the at least one controller further configured to control the operation of the fluid delivery and recovery systems during the unattended automatic cleanout mode of operation, and a storage tray configured to dock the surface cleaning apparatus in the upright storage position for recharging the battery of the surface cleaning apparatus and for self-cleaning of the surface cleaning apparatus, the storage tray comprising at least one charging contact, a power cord, and a wall charger configured to be plugged into a household outlet, wherein the surface cleaning apparatus comprises at least one corresponding charging contact configured to couple with the at least one charging contact of the storage tray when the surface cleaning apparatus is docked with the storage tray, wherein the at least one controller is configured to execute the unattended automatic cleanout mode of operation upon actuation of the self-cleaning mode input control, and wherein the self-cleaning mode of operation is operable only when the surface cleaning apparatus is docked on the storage tray, and wherein the surface cleaning apparatus comprises a battery charging circuit controlling the recharging of the rechargeable battery, wherein the battery charging circuit is disabled as a result of the actuation of the self-cleaning mode input control.

According to yet another aspect of the disclosure, a surface cleaning system includes a surface cleaning apparatus having an upright body comprising a handle and a frame, a base coupled with the upright body and adapted for movement across a surface to be cleaned, a moveable joint assembly mounting the base to the upright body, wherein the upright body is pivotable via the joint assembly between an upright storage position and a reclined use position, a fluid

delivery system comprising a supply tank, a pump, and a fluid distributor, a recovery system comprising a recovery pathway, a recovery tank, a suction nozzle, and a vacuum motor, a brushroll within the recovery pathway of the recovery system, a brushroll motor operably coupled to the brushroll for rotating the brushroll, wherein the suction nozzle is configured to extract fluid and debris from the brushroll, a rechargeable battery operably connected to at least one controller configured to selectively energize the pump, the brushroll motor, and the vacuum motor, a self-cleaning mode configured to initiate an unattended automatic cleanout mode of operation during which each of the pump, the brushroll motor, and the vacuum motor are energized, and at least one controller configured to execute the unattended automatic cleanout mode of operation, and a storage tray configured to dock the surface cleaning apparatus in the upright storage position, wherein, during the unattended automatic cleanout mode of operation, the at least one controller is configured to detect whether the surface cleaning apparatus is docked with the storage tray, energize the pump without the vacuum motor being energized, energize the brushroll motor without the vacuum motor being energized, and energize the vacuum motor after the brushroll motor and the pump are energized, whereby cleaning liquid is extracted and deposited into the recovery tank and a portion of the suction nozzle is flushed out.

According to still another aspect of the disclosure, a surface cleaning system includes an upright body comprising a handle and a frame, a base coupled with the upright body and adapted for movement across a surface to be cleaned, a moveable joint assembly mounting the base to the upright body, wherein the upright body is pivotable via the joint assembly between an upright storage position and a reclined use position, a fluid delivery system comprising a supply tank, a pump, and a fluid distributor, a recovery system comprising a recovery pathway, a recovery tank, a suction nozzle, and a vacuum motor, a brushroll within the recovery pathway of the recovery system, a brushroll motor operably coupled to the brushroll for rotating the brushroll, wherein the suction nozzle is configured to extract fluid and debris from the brushroll, a rechargeable battery, operably coupled to at least one controller, configured to selectively energize the pump, the brushroll motor, and the vacuum motor, at least one controller configured to control a battery charger circuit, for recharging of the rechargeable battery, and a self-cleaning mode configured to initiate an unattended automatic cleanout mode of operation during which each of the pump, the brushroll motor, and the vacuum motor are energized. The at least one controller is further configured to execute the unattended automatic cleanout mode of operation by energizing the pump to spray cleaning liquid from the supply tank onto the brushroll, energizing the brushroll motor to rotate the brushroll, and energizing the vacuum motor to extract cleaning liquid and flush out a portion of the suction nozzle, wherein the battery charging circuit is disabled during the unattended automatic cleanout mode of operation.

These and other features and advantages of the present disclosure will become apparent from the following description of particular embodiments, when viewed in accordance with the accompanying drawings and appended claims.

Before the embodiments of the invention are explained in detail, it is to be understood that the invention is not limited to the details of operation or to the details of construction and the arrangement of the components set forth in the following description or illustrated in the drawings. The invention may be implemented in various other embodi-

ments and of being practiced or being carried out in alternative ways not expressly disclosed herein. Also, it is to be understood that the phraseology and terminology used herein are for the purpose of description and should not be regarded as limiting. The use of "including" and "comprising" and variations thereof is meant to encompass the items listed thereafter and equivalents thereof as well as additional items and equivalents thereof. Further, enumeration may be used in the description of various embodiments. Unless otherwise expressly stated, the use of enumeration should not be construed as limiting the invention to any specific order or number of components. Nor should the use of enumeration be construed as excluding from the scope of the invention any additional steps or components that might be combined with or into the enumerated steps or components. Any reference to claim elements as "at least one of X, Y and Z" is meant to include any one of X, Y or Z individually, and any combination of X, Y and Z, for example, X, Y, Z; X, Y; X, Z; and Y, Z.

#### DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a surface cleaning apparatus according to one embodiment of the invention, showing the apparatus in an upright or storage position;

FIG. 2 is an enlarged side view of the surface cleaning apparatus from FIG. 1, showing the apparatus in a reclined position;

FIG. 3 is a cross-sectional view of the surface cleaning apparatus taken through line III-III of FIG. 1;

FIG. 4 is a partially exploded rear perspective view of a base of the surface cleaning apparatus, showing details of one embodiment of a wheel for the base.

FIG. 5 is a front perspective view of the base, with portion of the base partially cut away to show internal details of the base;

FIG. 6 is an enlarged view of section VI of FIG. 3, showing a forward section of the base including details of a brushroll, brush chamber, and a rigid interference wiper;

FIG. 7 is a partially exploded front perspective view of the base of the surface cleaning apparatus, showing details of one embodiment of a removable nozzle assembly;

FIG. 8 is an enlarged view of one end of the brushroll, showing details of one embodiment of a latch for the brushroll for the apparatus;

FIG. 9 is an enlarged view of a portion of the base, showing details of one embodiment of a mating component for the brushroll latch of FIG. 8;

FIG. 10 is a partially-exploded perspective view of the base, showing one embodiment of a drive transmission operably connecting the brushroll to a brush motor, and in which a portion of the base has been removed in order to better show the transmission;

FIG. 11 is a partially-exploded rear perspective view of the surface cleaning apparatus, showing one embodiment of a supply tank, receiver, and supply tank latch for the surface cleaning apparatus;

FIG. 12 is an enlarged view of section XII of FIG. 3, showing the supply tank and supply tank latch of FIG. 11;

FIG. 13 is an exploded view of one embodiment of a recovery tank for the surface cleaning apparatus;

FIG. 14 is a cross-sectional view through the recovery tank of FIG. 13;

FIG. 15 is a schematic view of one embodiment of a liquid level sensing system for the surface cleaning apparatus;

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FIG. 16A is a sectional view showing portions of a recovery pathway and a motor cooling air path of the apparatus;

FIG. 16B is a sectional view showing portions of a recovery pathway and a motor cooling air path of the apparatus;

FIG. 17 is a partially-exploded rear perspective view of the surface cleaning apparatus, showing portions of a working air exhaust path and a motor cooling air path of the apparatus;

FIG. 18 is a schematic control diagram for the surface cleaning apparatus;

FIG. 19 is an enlarged perspective view of the apparatus 10 docked with a storage tray according to one embodiment of the invention;

FIG. 20 is an enlarged cross-sectional view of a lower portion of the surface cleaning apparatus docked with the storage tray, taken through line XX-XX of FIG. 19;

FIG. 21 is an enlarged cross-sectional view of a lower portion of the surface cleaning apparatus taken through line XXI-XXI of FIG. 19, showing a shielded electrical contact of the apparatus;

FIG. 22 is an enlarged cross-sectional view of a portion of the storage tray taken through line XXII-XXII of FIG. 19, showing a shielded electrical contact of the tray;

FIGS. 23-25 illustrate a docking operation of the surface cleaning apparatus with the storage tray;

FIG. 26 is a perspective view of the storage tray from FIG. 19;

FIG. 27 is a block diagram for the surface cleaning apparatus, showing a condition when the surface cleaning apparatus is docked with the storage tray for recharging;

FIG. 28 shows the block diagram of FIG. 27 in a condition when the surface cleaning apparatus is docked with the storage tray in a self-cleaning mode; and

FIG. 29 is a flow chart showing one embodiment of a self-cleaning method for the surface cleaning apparatus.

#### DESCRIPTION OF EMBODIMENTS OF THE INVENTION

The invention generally relates to a surface cleaning apparatus, which may be in the form of a multi-surface wet vacuum cleaner.

The functional systems of the surface cleaning apparatus can be arranged into any desired configuration, such as an upright device having a base and an upright body for directing the base across the surface to be cleaned, a canister device having a cleaning implement connected to a wheeled base by a vacuum hose, a portable device adapted to be hand carried by a user for cleaning relatively small areas, or a commercial device. Any of the aforementioned cleaners can be adapted to include a flexible vacuum hose, which can form a portion of the working air conduit between a nozzle and the suction source. As used herein, the term “multi-surface wet vacuum cleaner” includes a vacuum cleaner that can be used to clean hard floor surfaces such as tile and hardwood and soft floor surfaces such as carpet.

The cleaner can include a fluid delivery system for storing cleaning fluid and delivering the cleaning fluid to the surface to be cleaned and a recovery system for removing the spent cleaning fluid and debris from the surface to be cleaned and storing the spent cleaning fluid and debris.

The recovery system can include a suction nozzle, a suction source in fluid communication with the suction nozzle for generating a working air stream, and a recovery container for separating and collecting fluid and debris from

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the working airstream for later disposal. A separator can be formed in a portion of the recovery container for separating fluid and entrained debris from the working airstream. The recovery system can also be provided with one or more additional filters upstream or downstream of the motor/fan assembly. The suction source, such as a motor/fan assembly, is provided in fluid communication with the recovery container and can be electrically coupled to a power source.

The suction nozzle can be provided on a base or cleaning head adapted to move over the surface to be cleaned. An agitator can be provided adjacent to the suction nozzle for agitating the surface to be cleaned so that the debris is more easily ingested into the suction nozzle. The agitator can be driven by the same motor/fan assembly serving as the suction source, or may optionally be driven by a separate drive assembly, such as a dedicated agitator motor as shown herein.

FIG. 1 is a perspective view of a surface cleaning apparatus 10 according to one aspect of the present disclosure. As discussed in further detail below, the surface cleaning apparatus 10 is provided with various features and improvements, which are described in further detail below. One example of a suitable surface cleaning apparatus in which the various features and improvements described herein can be used is disclosed in U.S. Pat. No. 10,092,155, issued Oct. 9, 2018, which is incorporated herein by reference in its entirety.

As illustrated herein, the surface cleaning apparatus 10 can be an upright multi-surface wet vacuum cleaner having a housing that includes an upright handle assembly or body 12 and a cleaning head or base 14 mounted to or coupled with the upright body 12 and adapted for movement across a surface to be cleaned. For purposes of description related to the figures, the terms “upper,” “lower,” “right,” “left,” “rear,” “front,” “vertical,” “horizontal,” “inner,” “outer,” and derivatives thereof shall relate to the disclosure as oriented in FIG. 1 from the perspective of a user behind the surface cleaning apparatus 10, which defines the rear of the surface cleaning apparatus 10. However, it is to be understood that the disclosure may assume various alternative orientations, except where expressly specified to the contrary.

The upright body 12 can comprise a handle 16 and a frame 18. The frame 18 can comprise a main support section supporting at least a supply tank 20 and a recovery tank 22, and may further support additional components of the body 12. The surface cleaning apparatus 10 can include a fluid delivery or supply pathway, including and at least partially defined by the supply tank 20, for storing cleaning fluid and delivering the cleaning fluid to the surface to be cleaned and a recovery pathway, including and at least partially defined by the recovery tank 22, for removing the spent cleaning fluid and debris from the surface to be cleaned and storing the spent cleaning fluid and debris until emptied by the user.

The handle 16 can include a hand grip 26 and a trigger 28 mounted to the hand grip 26, which controls fluid delivery from the supply tank 20 via an electronic or mechanical coupling with the tank 20. The trigger 28 can project at least partially exteriorly of the hand grip 26 for user access. A spring (not shown) can bias the trigger 28 outwardly from the hand grip 26. Other actuators, such as a thumb switch, can be provided instead of the trigger 28.

The surface cleaning apparatus 10 can include at least one user interface 30, 32 through which a user can interact with the surface cleaning apparatus 10. The at least one user interface can enable operation and control of the apparatus 10 from the user's end, and can also provide feedback



information from the apparatus 10 to the user. The at least one user interface can be electrically coupled with electrical components, including, but not limited to, circuitry electrically connected to various components of the fluid delivery and recovery systems of the surface cleaning apparatus 10, as described in further detail below.

In the illustrated embodiment, the surface cleaning apparatus 10 includes a human-machine interface (HMI) 30 having one or more input controls, such as but not limited to buttons, triggers, toggles, keys, switches, or the like, operably connected to systems in the apparatus 10 to affect and control its operation. The surface cleaning apparatus 10 also includes a status user interface (SUI) 32 which communicates a condition or status of the apparatus 10 to the user. The SUI 32 can communicate visually and/or audibly, and can optionally include one or more input controls. The HMI 30 and the SUI 32 can be provided as separate interfaces or can be integrated with each other, such as in a composite use interface, graphical user interface, or multimedia user interface. As shown, the HMI 30 can be provided at a front side of the hand grip 26, with the trigger 28 provided on a rear side of the hand grip 26, opposite the HMI 30, and the SUI 32 can be provided on a front side of the frame 18, below the handle 16 and above the base 14, and optionally above the recovery tank 22. In other embodiments, the HMI 30 and SUI 32 can be provided elsewhere on the surface cleaning apparatus 10. One example of a suitable HMI and/or SUI is disclosed in U.S. Provisional Application No. 62/747,922, filed Oct. 19, 2018, which is incorporated herein by reference in its entirety. Either user interface 30, 32 can comprise a proximity-triggered interface, as described in the '922 application.

The HMI 30 can include one or more input controls 34, 36 in register with a printed circuit board (PCB, not shown) within the hand grip 26. In one embodiment, one input control 34 is a power input control which controls the supply of power to one or more electrical components of the apparatus 10, as explained in further detail below, one of which may be the SUI 32. Another input control 36 is a cleaning mode input control which cycles the apparatus 10 between a hard floor cleaning mode and a carpet cleaning mode, as described in further detail below. One or more of the input controls 34, 36 can comprise a button, trigger, toggle, key, switch, or the like, or any combination thereof. In one example, one or more of the input controls 34, 36 can comprise a capacitive button.

The SUI 32 can include a display 38, such as, but not limited to, an LED matrix display or a touchscreen. In one embodiment, the display 38 can include multiple status indicators which can display various detailed apparatus status information, such as, but not limited to, battery status, WiFi connection status, clean water level, dirty water level, filter status, floor type, self-cleaning, or any number of other status information. The status indicators can be a visual display, and may include any of a variety of lights, such as LEDs, textual displays, graphical displays, or any variety of known status indicators.

The SUI 32 can include at least one input control 40, which can be adjacent the display 38 or provided on the display 38. The input control 40 can comprise a self-cleaning mode input control which initiates a self-cleaning mode of operation, as described in further detail below. The input control 40 can comprise a button, trigger, toggle, key, switch, or the like, or any combination thereof. In one example, the input control 40 can comprise a capacitive button.

The surface cleaning apparatus 10 can include a controller 308 (FIG. 3) operably coupled with the various functional systems of the apparatus, including, but not limited to, the fluid delivery and recovery systems, for controlling its operation. A user of the apparatus 10 can interact with the controller 308 via one or more of the user interfaces 30, 32. The controller 308 can further be configured to execute a cleanout cycle for the self-cleaning mode of operation. The controller 308 can have software for executing the self-cleaning cycle.

Referring additionally to FIG. 2, a moveable joint assembly 42 can be formed at a lower end of the frame 18 and moveably mounts the base 14 to the upright body 12. In the embodiment shown herein, the upright body 12 can pivot up and down about at least one axis relative to the base 14. The joint assembly 42 can alternatively comprise a universal joint, such that the upright body 12 can pivot about at least two axes relative to the base 14. Wiring and/or conduits can optionally supply electricity, air and/or liquid (or other fluids) between the base 14 and the upright body 12, or vice versa, and can extend through the joint assembly 42.

The upright body 12 can pivot, via the joint assembly 42, to an upright or storage position, an example of which is shown in FIG. 1, in which the upright body 12 is oriented substantially upright relative to the surface to be cleaned and in which the apparatus 10 is self-supporting, i.e. the apparatus 10 can stand upright without being supported by something else. A locking mechanism (not shown) can be provided to lock the joint assembly 42 against movement about at least one of the axes of the joint assembly 42 in the storage position, which can allow the apparatus 10 to be self-supporting. From the storage position, the upright body 12 can pivot, via the joint assembly 42, to a reclined or use position, in which the upright body 12 is pivoted rearwardly relative to the base 14 to form an acute angle with the surface to be cleaned. In this position, a user can partially support the apparatus by holding the hand grip 26. Another example of a reclined position is shown in FIG. 2, in which the upright body 12 can pivot further to at least partially rest on a floor surface.

In one embodiment, a bumper 44 is provided on a rear side of the upright body 12, for example at a lower rear side of the frame 18 and/or below the supply tank 20, to prevent scratching the floor surface when the upright body 12 is reclined. The provision of the bumper 44 can also prevent damage to the apparatus 10 or the floor surface if the apparatus 10 tips backwards when in the storage position. The bumper 44 can be made from a softer or more pliable material than the material for the frame 18 or housing of the upright body 12, i.e. a material that has a lower Young's modulus. In one example, the bumper 44 can be made from an elastomeric material, such as natural or synthetic rubber, such as ethylene propylene diene monomer (EPDM) or nitrile rubber, while the frame 18 is made from a harder and/or stiffer plastic material, such as polyvinyl chloride (PVC).

FIG. 3 is a cross-sectional view of the surface cleaning apparatus 10 through line III-III FIG. 1. The supply and recovery tanks 20, 22 can be provided on the upright body 12. The supply tank 20 can be mounted to the frame 18 in any configuration. In the present embodiment, the supply tank 20 can be removably mounted at the rear of the frame 18 such that the supply tank 20 partially rests in the upper rear portion of the frame 18 and is removable from the frame 18 for filling. The recovery tank 22 can be mounted to the frame 18 in any configuration. In the present embodiment, the recovery tank 22 can be removably mounted at the front

of the frame 18, below the supply tank 20, and is removable from the frame 18 for emptying.

The fluid delivery system is configured to deliver cleaning fluid from the supply tank 20 to a surface to be cleaned, and can include, as briefly discussed above, a fluid delivery or supply pathway. The cleaning fluid can comprise one or more of any suitable cleaning fluids, including, but not limited to, water, compositions, concentrated detergent, diluted detergent, etc., and mixtures thereof. For example, the fluid can comprise a mixture of water and concentrated detergent.

The supply tank 20 includes at least one supply chamber 46 for holding cleaning fluid and a supply valve assembly 48 controlling fluid flow through an outlet of the supply chamber 46. Alternatively, supply tank 20 can include multiple supply chambers, such as one chamber containing water and another chamber containing a cleaning agent. For a removable supply tank 20, the supply valve assembly 48 can mate with a receiving assembly on the frame 18 and can be configured to automatically open when the supply tank 20 is seated on the frame 18 to release fluid to the fluid delivery pathway.

The recovery system is configured to remove spent cleaning fluid and debris from the surface to be cleaned and store the spent cleaning fluid and debris on the surface cleaning apparatus 10 for later disposal, and can include, as briefly discussed above, a recovery pathway. The recovery pathway can include at least a dirty inlet 50 and a clean air outlet 52 (FIG. 1). The pathway can be formed by, among other elements, a suction nozzle 54 defining the dirty inlet, a suction source 56 in fluid communication with the suction nozzle 54 for generating a working air stream, the recovery tank 22, and at least one exhaust vent defining the clean air outlet 52.

The suction nozzle 54 can be provided on the base 14 can be adapted to be adjacent the surface to be cleaned as the base 14 moves across a surface. A brushroll 60 can be provided adjacent to the suction nozzle 54 for agitating the surface to be cleaned so that the debris is more easily ingested into the suction nozzle 54. While a horizontally-rotating brushroll 60 is shown herein, in some embodiments, dual horizontally-rotating brushrolls, one or more vertically-rotating brushrolls, or a stationary brush can be provided on the apparatus 10.

The suction nozzle 54 is further in fluid communication with the recovery tank 22 through a conduit 62. The conduit 62 can pass through the joint assembly 42 and can be flexible to accommodate the movement of the joint assembly 42.

The suction source 56, which can be a motor/fan assembly including a vacuum motor 64 and a fan 66, is provided in fluid communication with the recovery tank 22. The suction source 56 can be positioned within a housing of the frame 18, such as above the recovery tank 22 and forwardly of the supply tank 20. The recovery system can also be provided with one or more additional filters upstream or downstream of the suction source 56. For example, in the illustrated embodiment, a pre-motor filter 68 is provided in the recovery pathway downstream of the recovery tank 22 and upstream of the suction source 56. A post-motor filter (not shown) can be provided in the recovery pathway downstream of the suction source 56 and upstream of the clean air outlet 52.

The base 14 can include a base housing 70 supporting at least some of the components of the fluid delivery system and fluid recovery system, and a pair of wheels 72 for moving the apparatus 10 over the surface to be cleaned. The wheels 72 can be provided on rearward portion of the base

housing 70, rearward of components such as the brushroll 60 and suction nozzle 54. A second pair of wheels 74 can be provided on the base housing 70, forward of the first pair of wheels 72.

FIG. 4 is a partially exploded rear perspective view of the base 14. In one embodiment, the wheels 72, or rear wheels, can comprise an outer edge or rim 76 which holds a tread 78. The rim 76 has a width W1 and the tread 78 has a width W2, as shown in FIG. 4. The tread 78 can be narrower than the rim 76, i.e.  $W2 < W1$ , to reduce the contact width of the wheel 72 on the surface to be cleaned. The contact width of the wheel 72 can therefore be  $\leq W2$ . For example, a substantially flat tread 78 can provide a contact width substantially equal to the width of tread, i.e. substantially equal to W2, while a tread 78 with a curved or angled shape can provide a contact width somewhat less than the width of tread 78, i.e.  $< W2$ . The narrow tread 78 therefore reduces the occurrence and appearance of streaks on a cleaned floor surface which are caused by the wheels 72 rolling on the wet floor surface. Optionally, the tread 78 can be overmolded onto a crown 80 of the rim 76.

The wheels 72 can further include a hub 82 connected with the rim 76 and which receives an axle 84 on which the wheel 72 rotates. The axles 84 can be coupled with the base housing 70, and can further be coupled with rear housing extensions 86 of the base housing 70, to which a yoke 88 of the joint assembly 42 couples to pivot up and down relative to the base 14. The axles 84 can couple to an outer side of the housing extensions 86, while the yoke 88 couples to an inner side of the housing extensions 86. Optionally, the flexible conduit 62 can pass between the housing extensions 86 can up through the yoke 88.

FIG. 5 is a front perspective view of the base 14, with portion of the base 14 partially cut away to show some internal details of the base 14. In addition to the supply tank 20 (FIG. 3), the fluid delivery pathway can include a fluid distributor 90 having at least one outlet for applying the cleaning fluid to the surface to be cleaned. In one embodiment, the fluid distributor 90 can be one or more spray tips 92 on the base 14 configured to deliver cleaning fluid to the surface to be cleaned directly or indirectly by spraying the brushroll 60. Other embodiments of fluid distributors 90 are possible, such as a spray manifold having multiple outlets or a spray nozzle configured to spray cleaning fluid outwardly from the base 14 in front of the surface cleaning apparatus 10.

The fluid delivery system can further comprise a flow control system for controlling the flow of fluid from the supply tank 20 to the fluid distributor 90. In one configuration, the flow control system can comprise a pump 94 which pressurizes the system. The trigger 28 (FIG. 1) can be operably coupled with the flow control system such that pressing the trigger 28 will deliver fluid from the fluid distributor 90. The pump 94 can be positioned within a housing of the base 14, and is in fluid communication with the supply tank 20 via the valve assembly 48. Optionally, a fluid supply conduit can pass interiorly to joint assembly 42 and fluidly connect the supply tank 20 to the pump 94. In one example, the pump 94 can be a centrifugal pump. In another example, the pump 94 can be a solenoid pump having a single, dual, or variable speed.

In another configuration of the fluid supply pathway, the pump 94 can be eliminated and the flow control system can comprise a gravity-feed system having a valve fluidly coupled with an outlet of the supply tank 20, whereby when valve is open, fluid will flow under the force of gravity to the fluid distributor 90.

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Optionally, a heater (not shown) can be provided for heating the cleaning fluid prior to delivering the cleaning fluid to the surface to be cleaned. In one example, an in-line heater can be located downstream of the supply tank **20**, and upstream or downstream of the pump **94**. Other types of heaters can also be used. In yet another example, the cleaning fluid can be heated using exhaust air from a motor-cooling pathway for the suction source **56** of the recovery system.

The brushroll **60** can be operably coupled to and driven by a drive assembly including a dedicated brushroll motor or brush motor **96** in the base **14**. The coupling between the brushroll **60** and the brush motor **96** can comprise one or more belts, gears, shafts, pulleys or combinations thereof. Alternatively, the vacuum motor **64** (FIG. **3**) can provide both vacuum suction and brushroll rotation.

In the illustrated embodiment, the base housing **70** comprises a rear housing **98** which contains the pump **94** and the brush motor **96**. The flexible conduit **62** can pass between the pump **94** and the brush motor **96**, and can generally bisect the rear housing **98** into a pump cavity **100** and a brush motor cavity **102**. The rear housing extensions **86** can extend rearwardly from the rear housing **98**. A wiring conduit (not shown) can provide a passthrough for electrical wiring from the upright body **12** to the base **14** through joint assembly **42**. For example, the wiring can be used to supply electrical power to the pump **94** and brush motor **96**.

FIG. **6** is an enlarged view of section VI of FIG. **3**, showing a forward section of the base **14**. The brushroll **60** can be provided at a forward portion of the base **14** and received in a brush chamber **104** on the base **14**. The brushroll **60** is positioned for rotational movement in a direction R about a central rotational axis X. The brush chamber **104** can be forward of the rear housing **98**, and can be defined at least in part by the suction nozzle **54**, as described in more detail below. In the present embodiment the suction nozzle **54** is configured to extract fluid and debris from the brushroll **60** and from the surface to be cleaned.

An interference wiper **106** is mounted at a forward portion of the brush chamber **104** and is configured to interface with a leading portion of the brushroll **60**, as defined by the direction of rotation R of the brushroll **60**. The interference wiper **106** is below the fluid distributor **90**, such that the wetted portion brushroll **60** rotates past the interference wiper **106**, which scrapes excess fluid off the brushroll **60**, before reaching the surface to be cleaned. Optionally, the interference wiper **106** can be disposed generally parallel to the surface to be cleaned.

The wiper **106** can be rigid, i.e. stiff and non-flexible, so the wiper **106** does not yield or flex by engagement with the brushroll **60**. Optionally, the wiper **106** can be formed of rigid thermoplastic material, such as poly (methyl methacrylate) (PMMA), polycarbonate, or acrylonitrile butadiene styrene (ABS).

A squeegee **108** is mounted to the base housing **70** behind the brushroll **60** and the brush chamber **104** and is configured to contact the surface as the base **14** moves across the surface to be cleaned. The squeegee **108** wipes residual fluid from the surface to be cleaned so that it can be drawn into the recovery pathway via the suction nozzle **54**, thereby leaving a moisture and streak-free finish on the surface to be cleaned. Optionally, the squeegee **108** can be disposed generally orthogonal to the surface to be cleaned, or vertically. The squeegee **108** can be smooth as shown, or optionally comprise nubs on the end thereof.

The squeegee **108** can be pliant, i.e. flexible or resilient, in order to bend readily according to the contour of the

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surface to be cleaned yet remain undeformed by normal use of the apparatus **10**. Optionally, the squeegee **108** can be formed of a resilient polymeric material, such as ethylene propylene diene monomer (EPDM) rubber, polyvinyl chloride (PVC), a rubber copolymer such as nitrile butadiene rubber, or any material known in the art of sufficient rigidity to remain substantially undeformed during normal use of the apparatus **10**.

In the present example, brushroll **60** can be a hybrid brushroll suitable for use on both hard and soft surfaces, and for wet or dry vacuum cleaning. In one embodiment, the brushroll **60** comprises a dowel **110**, a plurality of bristles **112** extending from the dowel **110**, and microfiber material **114** provided on the dowel **110** and arranged between the bristles **112**. One example of a suitable hybrid brushroll is disclosed in U.S. Pat. No. 10,092,155, incorporated above. The bristles **112** can be arranged in a plurality of tufts or in a unitary strip. Dowel **110** can be constructed of a polymeric material such as acrylonitrile butadiene styrene (ABS), polypropylene or styrene, or any other suitable material such as plastic, wood, or metal. Bristles **112** can be tufted or unitary bristle strips and constructed of nylon, or any other suitable synthetic or natural fiber. The microfiber material **114** can be constructed of polyester, polyamides, or a conjugation of materials including polypropylene or any other suitable material known in the art from which to construct microfiber.

FIG. **7** is a partially exploded, perspective view of the base **14**. In one embodiment, the base **14** can comprise a removable nozzle assembly **116** coupled to the base housing **70** and defining at least the suction nozzle **54**. In one embodiment, the nozzle assembly **116** can comprise a nozzle housing **118**. The nozzle housing **118** can define the brush chamber **104** which partially encloses the brushroll **60**. Optionally, the wiper **106** is mounted at an interior forward side of the nozzle housing **118**, and projects into the brush chamber **104**.

The nozzle assembly **116** can comprise a hand grip **120** on the nozzle housing **118** which can be used to lift the nozzle assembly **116** away from the base housing **70**. The nozzle assembly **116** can comprise a cover **122** on which the hand grip **120** is provided, or the hand grip **120** can be provided directly on the nozzle housing **118**. The nozzle housing **118** and/or cover **122** can be formed from a translucent or transparent material, such that the brushroll **60** is at least partially visible to a user through the suction nozzle assembly **116**. A bumper **124** can be provided on the nozzle assembly **116**, such as at a lower front edge of the nozzle housing **118**. A base conduit **126** of the recovery pathway can be provided in the base housing **70** and can couple the nozzle housing **118**, particularly the suction nozzle **54** and brush chamber **104** defined by the nozzle housing **118**, with the flexible conduit **62**.

The fluid distributor **90** can optionally be integrated with the removable nozzle assembly **116**. The nozzle housing **118** can include at least one outlet opening **128** in register with the fluid distributor **90** for delivering fluid to the surface to be cleaned, including to the brushroll **60** or directly to the surface to be cleaned.

In one embodiment, the nozzle assembly **116** can define a pair of fluid delivery channels **130** that are each fluidly connected to one of the spray tips **92** at a terminal end thereof. Each spray tip **92** can include at least one outlet to deliver fluid to the surface to be cleaned, and can be in fluid communication with the brush chamber **104** to delivery fluid directly to the brushroll **60**, or directly to the surface to be

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cleaned. The spray tips **92** can optionally be oriented to spray fluid inwardly onto the brushroll **60**.

The fluid delivery channels **130** can be defined by lower channel halves **132** and upper channel halves **134**, which can be provided on mating components of the nozzle assembly **116**. In the embodiment shown, the lower channel halves **132** are provided on the nozzle housing **118** and the upper channel halves **134** are provided on a channel housing **136** which mates with the nozzle housing **118**, optionally beneath the cover **122**.

A fluid coupling can be provided between the nozzle assembly **116** and the base housing **70** in order to fluidly connect the pump **94** (FIG. 5) with the fluid delivery channels **130** when the nozzle assembly **116** is seated on the base housing **70**. In the illustrated embodiment, spray connectors **138** are provided on the base housing **70** and can comprise valves that are normally closed when the nozzle assembly **116** is removed from the base housing **70**. Installing the nozzle assembly **116** on the base housing **70** can automatically open the spray connectors **138** and permit fluid to flow into the delivery channels **130**. Optionally, a fluid supply conduit (not shown) can fluidly connect the pump **94** to the spray connectors **138**.

A nozzle latch **140** can be provided to releasably secure the nozzle assembly **116** on the base housing **70**. The nozzle latch **140** can be received in a latch receiver **142** provided on the base housing **70**, and be biased by a spring **144** to a latched position. The nozzle latch **140** can be configured to releasably latch or retain, but not lock, the nozzle assembly **116** to the base housing **70**, such that a user can conveniently apply sufficient force to the nozzle assembly **116** itself, such as via the hand grip **120**, to pull the nozzle assembly **116** off the base housing **70**. Optionally the latch **140** can be carried by the channel housing **136**.

The base **14** can have at least one indicator light **146** configured to activate in combination with the pump **94** (FIG. 5) when trigger **28** (FIG. 1) is depressed to deliver fluid. In the illustrated embodiment, the indicator light **146** includes at least one light emitting diode (LED) or other illumination source provided on the base housing **70**, and more particularly provided on the rear housing **98**. The indicator light **146** can be positioned behind the nozzle cover **122**, which can be formed from a translucent or transparent material, such that the illumination from the indicator light **146** is at least partially visible to a user from the exterior of the base **14**. Electrical wiring for the indicator light **146** can be passed through the joint assembly **42** from the upright body **12** to the base **14** through joint assembly **42**.

Optionally, the brushroll **60** can be configured to be removed by the user from the base **14**, such as for cleaning and/or drying the brushroll **60**. The brushroll **60** can be removably mounted in the brush chamber **104** by a brushroll latch **148** which is coupled with the brushroll **60**. Accordingly, the nozzle assembly **116** may be removed from the base housing **70** prior to removing the brushroll **60**. In other embodiments, the brushroll **60** and latch **148** can be configured such that prior removal of the nozzle assembly **116** is not required.

The brushroll latch **148** can be received by a mating component **150** on the base housing **70**. In one embodiment, the base housing **70** can include spaced lateral sidewalls **152** which define a cavity **154** therebetween. The mating component **150** can be provided on an inner surface of one of the lateral sidewalls **152**. The lateral sidewalls **152** can extend forwardly from the rear housing **98**. Optionally, the lateral

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sidewalls **152** can form a portion of the brush chamber **104**, such as by enclosing open lateral ends **156** of the nozzle housing **118**.

The latch **148** can be provided on one end of the dowel **110** of the brushroll **60**. The opposite end of the dowel **110** can have a splined drive connection **158** with a drive head **160** of a transmission operably connecting the brush motor **96** (FIG. 5) to the brushroll **60**. The drive head **160** can be provided at the lateral sidewall **152** opposite the mating component **150**.

With additional reference to FIGS. 8-9, the brushroll latch **148** can have a latch body **162** that is received by a latch body receiver **164** of the mating component **150**. The latch body **162** can be complementary to or keyed with the receiver **164** to ensure proper installation of the brushroll **60**. In the illustrated embodiment, the latch body **162** and the receiver **164** can have complementary U-shapes and can optionally taper in the insertion direction of the brushroll **60**, i.e. downwardly.

The brushroll latch **148** can comprise a protruding part **166** which is snap fit with the mating component **150** on the base housing **70**. In one embodiment, the protruding part **166** include at least one, and optionally two, cantilever part **168** having a hook, stud, lug, bead, or other engagement element **170** at an end thereof. The protruding part **166** is deflected briefly during the joining operation and catches in a depression or undercut **172** in the mating component **150**, optionally in the latch body receiver **164**. The depression or undercut **172** is shaped to allow separation of the brushroll **60** and from the base housing **70**.

The brushroll latch **148** can form part of an outer perimeter of the base housing **70**, which can improve edge cleaning by enabling the end of the brushroll **60** to extend closer to the lateral edge of the base **14**. For example, a portion of the brushroll latch **148** can form a portion of the lateral sidewall **152** of the housing **70** when the brushroll **60** is installed. When assembled, the brushroll latch **148** can form an exterior surface of the base **14**. Using the brushroll latch **148** to form a portion of the base housing **70**, rather than having the brushroll latch **148** abut up against an outer wall of the base housing **70**, eliminates bulk without sacrificing housing strength, allowing the brushroll **60** to be closer to the lateral edge of the base **14**.

The brushroll latch **148** can include a release tab **174**, which can be coupled with the latch body **162**, and which a user can grip to remove the brushroll **60**. The release tab **174** can form a portion of one of the lateral sidewalls **152** of the base housing **70**, which can improve edge cleaning by enabling the end of the brushroll **60** to extend closer to the lateral edge of the base **14**. In the illustrated embodiment, the release tab has a top edge or surface **176** that is continuous with a top edge or surface **178** on the lateral sidewall **152** when the brushroll **60** is installed on the base housing **70**. When assembled, the top edge or surface **176**, and optionally only the top edge or surface **176**, of the release tab **174** is visible, and can form an exterior surface of the base **14**.

The release tab **174** can be captured by the removable nozzle assembly **116** upon installation of the brushroll **60** on the base housing **70**, which can prevent unintended release of the brushroll **60**. Optionally, a portion of the nozzle assembly **116** can overlie a tab or shoulder **180** on the latch **148** to prevent upward movement of latch **148**, and therefore the brushroll **60**, when the nozzle assembly **116** is installed. In the embodiment shown, the nozzle cover **122** overlies the shoulder **180**.

The release tab **174** can optionally include a gripping feature **182** to assist in lifting the brushroll **60**. The gripping

feature **182** can be hidden by the nozzle assembly **116** when installed on the base housing **70** and revealed upon removal of the nozzle assembly **116** from the base housing **70**. The gripping feature **182** can be provided a portion of the latch **148** extending above the brushroll **60**.

The latch **148** and lateral sidewall **152** can include one or more additional mating surfaces or joints which help distribute the weight of the brushroll **60** supported by the lateral sidewall **152**. In the illustrated embodiment, the latch **148** includes a slot **184** on a lower side of the top surface **176** that receives a thin ridge **186** on the lateral sidewall **152**; the slot **184** and ridge **186** together form a tongue and groove joint between the latch **148** and the lateral sidewall **152**. Alternatively or additionally, the latch **148** can include a tab or shoulder **188** which rests on a ledge **190** of the mating component **150**.

Referring to FIG. **10**, an example of a transmission **192** for the brushroll **60** (FIG. **7**) is shown. The transmission **192** connects the brush motor **96** to the brushroll **60** for transmitting rotational motion of a motor shaft **194** of the brush motor **96** to the brushroll **60**. The transmission **192** can include a V-belt **196** (or vee belt) and one or more gears, shafts, pulleys, or combinations thereof. The V-belt **196** is narrower than other types of belts conventionally used for surface cleaning apparatus, such as flat belts or cog belts, which can increase available space within the base **14** and improve edge cleaning by enabling the end of the brushroll **60** to extend closer to the lateral edge of the base **14**, for example closer to the lateral sidewall **152** on the transmission side. As an additional benefit, the V-belt **196** is quieter than other belts conventionally used for surface cleaning apparatus and reduces operational noise of the apparatus.

In addition to the V-belt **196**, the transmission **192** can, for example, include a pulley **198** coupled with the motor shaft **194** and a pulley **200** coupled with brushroll **60**, with the V-belt **196** coupling the motor pulley **198** with the brushroll pulley **200**. The V-belt **196** can be a multi-groove or poly-groove belt with multiple “V” shape ribs **202** alongside each other, which track in mating grooves **204**, **206** in the motor and brushroll pulleys **198**, **200**, respectively. Because the V-belt **196** tends to wedge into the mating grooves **204**, **206**, sufficient torque transmission can be provided with less belt width and tension, for example as compared to a flat belt.

The transmission **192** can further include the drive head **160** keyed to or otherwise fixed with the brush pulley **200** by an axle **208**. A bearing **210** may also be carried on the axle **208**. The brushroll pulley **200** can be keyed to or otherwise fixed with the motor shaft **194**, and secured thereon by a retaining ring **212**.

It is noted that in FIG. **10**, a portion of the base housing **70** has been removed in order to view the transmission **192** and an optional drive housing **214** for the transmission **192**. The drive housing **214** can be formed with or otherwise coupled to the lateral sidewall **152** on the transmission side.

Referring to FIG. **11**, the upright body **12** comprises tank sockets or receivers **216**, **218** for respectively receiving the supply and recovery tanks **20**, **22**. As shown herein, in one embodiment the tank receivers **216**, **218** can be defined by portions of the frame **18**, and can be provided on opposing sides of the frame **18**, and more particularly on rear and front sides of the frame **18**, respectively. The supply and recovery tanks **20**, **22** can include externally-facing surfaces **220**, **222**, which form external surfaces of the apparatus **10** when the tank **20**, **22** are seated in the receivers **216**, **218**. Optionally, the tank **20**, **22** can have hand grips **224**, **226** provided on the externally-facing surfaces **220**, **222**. As shown herein, the supply tank hand grip **224** comprises hand grip indentations

formed in its externally-facing surface **220**, and the recovery tank hand grip **226** comprises a handle projecting from its externally-facing surface **222**, although other configurations are possible for each.

Referring to FIGS. **11-12**, the supply tank receiver **216** include a latch **228** for securing the supply tank **20** to the upright body **12**. The latch **228** facilitates correct installation and better sealing of the supply tank **20**, which alleviates user error and misassembly. The latch **228** can be configured to releasably latch or retain, but not lock, the supply tank **20** to the upright body **12**, such that a user can conveniently apply sufficient force to the supply tank **20** itself to pull the supply tank **20** off the frame **18**. In one embodiment, the latch **228** for the supply tank **20** can comprise a biased latch configured to release the supply tank **20** upon application a sufficient force to overcome the biased latching force of the latch **228**. More specifically, the latch **228** can comprise a spring-biased latch. One example of a suitable latch is disclosed in U.S. Provisional Application No. 62/638,477, filed Mar. 5, 2018, which is incorporated herein by reference in its entirety.

In the embodiment illustrated herein, the supply tank receiver **216** can include a support wall **230** and an overhanging wall **232** provided on the frame **18**, below the handle **16**. The overhanging wall **232** can extend outwardly to overhang at least a portion of the support wall **230**. The lower end of the supply tank **20** can comprise one or more internally-facing surfaces **234** adapted to rest on the support wall **230** of the receiver **216**. Optionally, the supply tank **20** can include an indent **236** in a sidewall thereof which rests on a platform **238** of the support wall **230**. The upper end of supply tank **20** can comprise one or more internally-facing surfaces **240** adapted to confront the overhanging wall **232** when the supply tank **20** is installed on the frame **18**. Optionally, the supply tank receiver **216** can have substantially open sides.

The latch **228** can be provided on the frame **18** of the upright body **12**. More specifically, as shown in the embodiment illustrated herein, the latch **228** can be provided on the overhanging wall **232** of the supply tank receiver **216**. When the supply tank **20** is seated within the supply tank receiver **216**, the supply tank **20** rests on the support wall **230** and is retained in place by the latch **228** on the overhanging wall **232**. Alternatively, the latch **228** can be provided elsewhere on the receiver **216**.

A valve seat **242** can be formed in the supply tank receiver **216**, such as in the support wall **230**, for receiving the supply valve assembly **48** controlling fluid flow through an outlet of the supply chamber **46** when the supply tank **20** is seated within the supply tank receiver **216**. The supply valve assembly **48** can be adapted to open upon the seating of the supply tank **20** within the supply tank receiver **216**, and to close upon removal of the supply tank **20** from the supply tank receiver **216**.

In the embodiment illustrated herein, the frame **18** includes a pocket **246** formed therein for mounting the latch **228**. More particularly, the pocket **246** can be provided in the overhanging wall **232** of the receiver **216**.

The latch **228** can include a latch member **248** and a biasing member **250** configured to bias the latch member **248** outwardly from the pocket **246**. In one embodiment, the latch member **248** can comprise a spring-biased latch and the biasing member **250** can specifically comprise a spring, such as a coil spring. As shown herein, the spring **250** can be retained between the latch member **248** and the pocket **246**. The latch member **248** is moveable relative to the pocket **246** and is constrained by the pocket **246** for axial

movement along a latch axis, which can be substantially parallel to the longitudinal axis of the upright body 12 or handle 16.

The supply tank 20 includes a catch 252 for the latch 228. The catch 252 is configured to be retained by the latch 228 to releasably hold the supply tank 20 in the receiver 216. As shown herein, the catch 252 can be formed on one of the internally-facing surfaces of the supply tank 20 such that the catch 252 and latch 228 are hidden when the supply tank 20 is seated in the receiver 216. More specifically, the catch 252 can be formed on the upper internally-facing surface 240 of the supply tank 20, which confronts the overhanging wall 232. The supply tank 20 can be shaped to facilitate movement of the latch 228 during installation, such as having an angled lead-in portion 254 on the upper internally-facing surface 240. In an embodiment where the supply tank 20 comprise a blow-molded tank body 256, the catch 252 can be formed integrally in an upper portion of the blow-molded tank body 256 forming the upper end of the tank 20.

The supply tank 20 can be installed on the frame 18 in accordance with the following method. The bottom of the supply tank 20 is inserted into the receiver 216, with the supply valve assembly 48 in register with the valve seat 242, and the upper portion of the supply tank 20 is rotated toward the receiver 216 to seat the supply tank 20. During installation, the angled lead-in portion 254 of the supply tank 20 rides under the latch 228 and causes the latch member 248 to compress the spring 250, and retract into the pocket 246. When the supply tank 20 is seated, the latch member 248 clears the angled lead-in portion 254 of the supply tank 20 and the spring 250 forces the latch member 248 to extend out of the pocket 246 and into the latched position shown in FIG. 12.

To remove the supply tank 20, the user can conveniently apply sufficient force to the supply tank 20 itself, such as by gripping the hand grips 224, to pull the supply tank 20 off the frame 18. Upon application a sufficient force via engagement of the catch 252 with the latch member 248 to overcome the biasing force of the spring 250, the latch member 248 is forced deeper into the pocket 246 and clears the catch 252, thereby releasing the supply tank 20 to be lifted away from the frame 18.

FIG. 13 is a partially exploded perspective view of one embodiment of the recovery tank 22 and FIG. 14 is a cross-sectional view of the recovery tank 22. The recovery tank 22 can include a recovery tank container 258, which forms a collection chamber 260 for the fluid recovery system, with a hollow standpipe 262 therein. The standpipe 262 can be oriented such that it is generally coincident with a longitudinal axis of the tank container 258. The standpipe 262 forms a flow path between a tank inlet 264 formed at a lower end of the tank container 258 and a tank outlet 266 at the upper end of the standpipe 262 within the interior of the tank container 258. When the recovery tank 22 is mounted to the frame 18 as shown in FIG. 3, the inlet 264 is aligned with the flexible conduit 62 to establish fluid communication between the base 14 and the recovery tank 22. The standpipe 262 can be integrally formed with the tank container 258.

The recovery tank 22 further includes a lid 268 sized for receipt on the tank container 258. The lid 268 at least partially encloses an open top of the tank container 258 and can further define an air outlet 270 of the recovery tank 22 leading to the downstream suction source 56. A gasket 272 is positioned between mating surfaces of the lid 268 and the tank container 258 and creates a seal therebetween for prevention of leaks.

A recovery tank latch 274 can optionally be supported by the lid 268 for securing the recovery tank 22 to the upright body 12 within the recovery tank receiver 218 (FIG. 11). The latch 274 can be configured to releasably lock the recovery tank 22 to the upright body 12, such that a user must actuate the latch 274 before pulling the tank 22 off the frame 18. The hand grip 226 on the recovery tank 22 can be located below the latch 274 and can facilitate removal of the recovery tank 22 from the frame 18.

The recovery tank 22 can further include a filter 276 provided at the air outlet 270. The filter 276 can be supported by the lid 268 and can comprise a pleated filter. In one embodiment, the pleated filter is made of a material that remains porous when wet. A mesh screen 278 can be carried by the lid 268 and can support the filter 276 thereon.

The recovery tank 22 can further include a removable strainer 280 configured to strain large debris and hair out of the tank container 258 prior to emptying. The strainer 280 is configured to collect the large debris and hair while draining fluid (e.g. liquid) and smaller debris back into the tank container 258. One example of a suitable strainer is disclosed in U.S. Patent Application Publication No. 2019/0159646, filed Nov. 30, 2017, which is incorporated herein by reference in its entirety.

For purposes of this description, large debris are any debris with a maximum dimension, such as a length or diameter, of greater than or equal to 0.5 mm to 6 mm, and preferably 3 mm, whereas small debris are any debris having a maximum dimension, such as a length or diameter, of less than that of the larger debris. An example of a piece of large debris includes a strand of hair with a length greater than 3 mm. Examples of small debris include coffee grounds and crumbs with diameters less than 3 mm.

The strainer 280 can comprises an elongated handle or grip 282 and a base 284. The strainer 280 can be removably mounted within the tank container 258 such that the base 284 is at a bottom end of the tank container 258 and the grip 282 extends toward a top end of the tank container 258. The base 284 can include a plurality of drain holes 286 for draining fluid when the strainer 280 is removed from the tank container 258, and optionally a raised rim 288 around its perimeter for containing debris. An opening 290 can also be provided in the base 284 for accommodating the standpipe 262. The base 284 can form a cup-shaped colander that retains large debris and hair.

The drain holes 286 can be circular or non-circular openings or apertures in the base 284. In one example, the size of the drain holes 286 can range in diameter from 0.5 mm to 6 mm, and optionally from 3 mm to 4 mm. Other embodiments of drain holes 286 are possible, including the strainer 280 having a grid or mesh on the base 284 defining the drain holes 286.

The base 284 can be configured to fit within the tank container 258 at a location spaced from a bottom wall 292 thereof. When the strainer 280 is inserted into the tank container 258, fluid and small debris can pass through the drain holes 286 to the area of the collection chamber 260 below the base 284, while large debris and hair is trapped above the base 284. Optionally, a stop 294 can be provided on the standpipe 262 that limits the insertion of the strainer 280 into the tank container 258 to maintain the base 284 spaced above the bottom wall 292.

As shown, the grip 282 can extend upwardly and/or vertically along the inner surface of the tank container 258 and can be oriented such that it is generally parallel to the longitudinal axis of the tank container 258, and optionally also to the standpipe 262. The strainer 92806 shown herein

is further inserted and removed from the tank container **258** along a direction that is parallel to, or coincident with, the longitudinal axis of the tank container **258**.

The base **284** extends from a lower end of the grip **282** to substantially cover the bottom wall **292** of the tank container **258**, such that any large debris/hair is trapped by the base **284** above the bottom wall **292**. The grip **282** can be offset and relatively slender to maximize space available in the collection chamber **260** for collecting debris and fluid.

In typical recovery tanks, large debris and hair is not strained out and is disposed of together with the fluid waste (e.g. liquid waste), which can potentially result in clogged drains and pipes. Alternatively, large debris and hair can be manually picked out of the recovery tank, which is unsanitary and laborious. With the strainer **280** according to the embodiment of the present invention disclosed herein, a user can simply remove the lid **268** and lift the strainer **280** out. The strainer **280** separates out large debris and hair while fluid and smaller debris drains back into the tank container **258**. The long grip **282** prevents a user from contact with any of the collected debris or fluid. Thus, a user can easily and sanitarily dispose of any large debris and hair in the trash, prior to emptying the fluid waste down a sink, toilet, or other drain thereby avoiding the problems with prior recovery tanks. The strainer **280** can be particularly helpful for use with a multi-surface vacuum cleaner because these types of vacuum cleaners ingest wet and dry debris, including large dry debris, and deposit the debris mixture into a single recovery tank.

In one embodiment, the recovery tank **22** can have a liquid level sensing system **296** configured to detect liquid at one or more levels within the recovery tank **22** and determine when to shut-off or otherwise interrupt the recovery system. The sensing system **296** can include any suitable components for sensing liquid within the recovery tank **22**. With the provision of the sensing system **296**, the recovery tank **22** does not require an in-tank float-style shut off. In other words, the recovery tank **22** is a floatless tank. One example of a suitable floatless tank and sensing system is disclosed in U.S. Provisional Application No. 62/688,428, filed Jun. 22, 2018, which is incorporated herein by reference in its entirety. The '428 application further discloses a system and method for sensing foam in the tank **22**, which can be provided on the apparatus **10** shown herein.

In the illustrated example, the sensing system **296** includes at least one sensor **298, 300**, optionally in the form of at least one probe, which can detect liquid. In the illustrated embodiment, two sensors **298, 300** in the form of probes are included, through other numbers and forms of sensors are possible. The sensors **298, 300** can be electrically coupled with power terminals **302**, optionally provided on the lid **268**, which couple with electrical contacts (not shown) on the recovery tank receiver **218** when the recovery tank **22** is mounted on the frame **18** to supply power to the sensors **298, 300**. The electrical contacts on the recovery tank receiver **218** are electrically coupled with a power source of the apparatus **10**, an example of which is described in further detail below.

The sensors **298, 300** can optionally be supported by the lid **268** or, or more particularly by at least one bracket **306** formed on or otherwise coupled with the lid **268**. In the illustrated embodiment, two brackets **306** depending downwardly from the lid **268** are included, through other numbers and forms of brackets are possible. The brackets **306** can be offset from the standpipe **262**. When the lid **268** is coupled to the container **258**, the brackets **306** can project into the collection chamber **260**. It is further contemplated that the

sensors **298, 300** can be molded directly into the side walls of the container **258**, thereby eliminating the brackets **306**.

FIG. **15** is a schematic view of the sensing system **296** for the apparatus **10**. The various sensors **298, 300** are coupled with a controller **308**. The controller **308** can also be operationally connected to other components of the apparatus **10**, as described in further detail below. The first sensor **298** can emit a liquid sensing signal **310** from the controller **308** at a given frequency **312**. The liquid sensing signal **310** travels through contents of the recovery tank **22** to form a liquid response signal **314** that is detected by the second sensor **300** and communicated to the controller **308**. The second sensor **300** can be located in the recovery tank **22** at a critical liquid level **316**. The term critical liquid level is used herein to define a level or location where, if liquid is present, at least one electrical component of the apparatus **10** is shut down to prevent liquid ingress into the suction source **56**. If the liquid response signal **314** indicates that the liquid in the recovery tank **22** is at or above the critical level **316**, the controller **308** can turn off the at least one electrical component of the apparatus **10**. Such components can include the suction source **56** itself, and more particularly the vacuum motor **64**, and optionally also the pump **94** and/or the brush motor **96**.

In yet another configuration, the controller **308** can additionally or alternatively activate a shut-off valve **318** in response to the liquid response signal **314** to prevent liquid ingress into the suction source **56**. The shut-off valve **318** can be provided for interrupting suction when liquid in the recovery tank **22** reaches the critical level **316**. The shut-off valve **318** can be positioned in any suitable manner and include any suitable type of valve.

Additionally or alternatively, the controller **308**, based on the liquid response signal **314**, can provide a visual or audible status indication such as a light or sound via the SUI **32**. The visual or audible status indication can alert the user that the liquid is too high in the recovery tank **22** or that a component of the apparatus **10** has been turned off.

Optionally, the sensing system **296** can include electronic components to capacitively couple and smooth the response signals such that the rise time or the average amplitude of the voltage of the received signals can be determined. In another non-limiting example, the controller **308** can be configured to perform one or more signal processing algorithms on the received response signals to determine one or more characteristics of the received response signal. Signal processing algorithms incorporated into the controller **308** for assisting in the determination of one or more characteristics of the received signals can include, but are not limited to, blind source separation, principal component analysis, singular value decomposition, wavelet analysis, independent component analysis, cluster analysis, Bayesian classification, etc.

It is contemplated that any of the sensors **298, 300** of the sensing system **296** can be configured to transmit, receive or transmit and receive one or more sensing signals. The sensing signals can include any waveform useful in sensing liquid, including, but not limited to, square waves, sine waves, triangle waves, sawtooth waves, and combinations thereof. Furthermore, the sensing signals can include any frequency useful in sensing liquid, including, but not limited to, frequencies ranging from approximately 10 kilohertz to 10 megahertz. In one non-limiting example, the liquid sensing signals can be multiplexed and transmitted simultaneously to one or more sensors.

The recovery tank **22** can be periodically emptied of collected fluid and debris by removing the recovery tank **22**

from the frame 18, removing the lid 268 from the tank container 258, which also removes the sensors 298, 300 and brackets 306. Next, a user lifts the strainer 280 out of the tank container 258. As the strainer 280 is lifted, large debris and hair is captured while fluid and smaller debris is allowed to drain back into the container 258. The user can then dispose of any debris on the strainer 280 in the trash, and then dispose of the remaining fluid and smaller debris in the tank container 258 in a sink, toilet, or other drain.

Referring to FIGS. 16A, 16B, and 17, downstream of the recovery tank 22, the recovery pathway can include suction source 56 and at least one exhaust vent 328 defining the clean air outlet 52. In the illustrated embodiment, two exhaust vents 328 are provided on opposing sides of the frame 18, through other numbers and locations for the exhaust vents 328 are possible. The vacuum motor 64 is enclosed within a motor housing 330 and the fan 66 is enclosed within a fan housing 332 and the housings 330, 332 may be made of one or more separate pieces. The fan housing 332 includes at least one inlet aperture 334 for drawing working air into the fan housing 332 and at least one outlet aperture 336 through which working air is exhausted. The recovery tank receiver 218 can include a grille 338 in register with the inlet aperture 334 and in fluid communication with the air outlet 270 of the recovery tank 22 when the tank 22 is seated in the receiver 218.

The recovery pathway can further include a portion defining an air exhaust path, which extends from the fan outlet aperture 336 to the clean air outlet or exhaust vents 328. The air exhaust path can be defined by at least one working air exhaust duct or conduit 342, with the fan outlet aperture 336 in fluid communication with a first end of exhaust conduit 342 and the clean air outlet 52 in fluid communication with a second end of the exhaust conduit 342.

The exhaust conduit 342 can be formed internally between housings of the upright body 12, and more specifically can be formed between housings forming the frame 18. Routing the working air exhaust internally within the handle housings reduces noise from the vacuum motor 64. In the illustrated embodiment, the exhaust conduit 342 can be formed by first and second frame housings 344, 346. The first frame housing 344 can define an exterior surface of the upright body 12 which is visible to the user, including a portion of a rear of the frame 18. The second frame housing 346 can define an interior surface of the upright body 12 which is not visible to the user and which can be at least partially covered by the first frame housing 344. The first and second frame housings 344, 346 can include mating portions of the exhaust conduit 342. The first and second frame housings 344, 346 can optionally comprise molded parts, with the mating portions of the exhaust conduit 342 integrally formed therewith. Optionally, the first frame housing 344 can define the supply tank receiver 216. In this case, the supply tank 20 mounted on the supply tank receiver 216 provides further insulation from operational noise generated by the vacuum motor 64.

The exhaust conduit 342 can include at least one louver or baffle which directs air flow. The at least one louver or baffle can provide a tortuous exhaust path that extends from the fan outlet aperture 336 to the exhaust vents. The tortuous exhaust path can comprise multiple turns of at least 90 degrees, and can optionally include at least one turn of greater than 90 degrees, for example 180 degrees or greater. In the embodiment shown, a 90 degree turn is provided into the exhaust conduit 342 at the fan outlet aperture 336, and a 180 degree turn is provided at a baffle 348 separating

sections of the exhaust conduit 342. The sections of the exhaust conduit 342 separated by the baffle 348 can run parallel to each other, which increases the length of the exhaust path to further reduces noise at the exhaust vents.

In one embodiment, a motor cooling air path is provided for supplying cooling air to the vacuum motor 64 and for removing heated cooling air (also referred to herein as "heated air") from the vacuum motor 64. The motor cooling air path includes a cooling air inlet and a cooling air outlet, both of which are in fluid communication with the ambient air outside the apparatus 10. Ambient air is drawn into the apparatus 10 through the cooling air inlet, passes through the vacuum motor 64, and is subsequently exhausted through the cooling air outlet. In the embodiment illustrated, the cooling air inlet is provided by gaps between the housings forming the upright body 12, including between the first frame housing 344 and a third frame housing 352. The third frame housing 352 can define an exterior surface of the upright body 12 which is visible to the user, including a portion of a side and/or front of the frame 18. Alternatively, a dedicated cooling air inlet can be provided in the upright body 12, such as through one of the housings of the frame 18. The cooling air outlet is provided by the clean air outlet 52, i.e. the exhaust vents 328, and as such the motor cooling air path and the working air exhaust path share a common outlet.

The motor housing 330 includes at least one inlet aperture 354 for allowing cooling air to enter the motor housing 330 and pass by the vacuum motor 64, and at least one outlet aperture 356 through which heated cooling air is exhausted. The motor cooling air path can be defined by at least one heated air exhaust duct or conduit 358 for allowing heated air to be transported away from the vacuum motor 64, with the motor outlet aperture 356 in fluid communication with a first end of the exhaust conduit 358 and the exhaust vents 328 in fluid communication with a second end of the exhaust conduit 358.

The heated air exhaust conduit 358 can be formed internally between housings of the upright body 12, and more specifically can be formed between the first and second frame housings 344, 346 forming the frame 18. Routing the heated air exhaust internally within the handle housings 344, 346 reduces noise from the vacuum motor 64. The first and second frame housings 344, 346 can include mating portions of the heated air exhaust conduit 358. The first and second frame housings 344, 346 can optionally comprise molded parts, with the mating portions of the exhaust conduit 358 integrally formed therewith. In the illustrated embodiment, the motor outlet aperture 356 can jut rearwardly to an opening 360 in the second frame housing 346 to enter the heated air exhaust conduit 358.

Optionally, the motor cooling air path can have a tortuous exhaust path that extends from the motor outlet aperture 356 to the exhaust vents, and include at least one louver or baffle (not shown) which directs air flow. The motor and airflow noise generated by the apparatus 10 during operation is dampened by the tortuous exhaust path. The tortuous exhaust path can comprise multiple turns of at least 90 degrees. In the embodiment shown, a first 90 degree turn is provided into the exhaust conduit 358 at the motor outlet aperture 356, and a second 90 degree turn is provided at a passage 362 separating a first section of the exhaust conduit 358 from a second section which includes the exhaust vents 328.

FIG. 18 shows one example of a schematic control diagram for the apparatus 10. As briefly mentioned above, the surface cleaning apparatus 10 can further include a



controller 308 operably coupled with the various function systems, such as the fluid delivery and recovery systems, of the apparatus 10 for controlling its operation. The controller 308 is operably coupled with the HMI 30 for receiving inputs from a user and with the SUI 32 for providing one or more indicia about the status of the apparatus 10. In one embodiment, the controller 308 can comprise a microcontroller unit (MCU) that contains at least one central processing unit (CPU). In the embodiment shown, the controller 308 is operably coupled with at least the vacuum motor 64, the pump 94, and the brush motor 96 for the brushroll 60.

Electrical components of the surface cleaning apparatus 10, including the vacuum motor 64, the pump 94, and the brush motor 96 for the brushroll 60, can be electrically coupled to a power source such as a battery 372 or a power cord plugged into a household outlet. In the illustrated embodiment, the power source comprises a rechargeable battery 372. In one example, the battery 372 can be a lithium ion battery. In another exemplary arrangement, the battery 372 can comprise a user replaceable battery.

As discussed above, the power input control 34 which controls the supply of power to one or more electrical components of the apparatus 10, and in the illustrated embodiment controls the supply of power to at least the SUI 32, the vacuum motor 64, the pump 94, and the brush motor 96. The cleaning mode input control 36 cycles the apparatus 10 between a hard floor cleaning mode and a carpet cleaning mode. In one example of the hard floor cleaning mode, vacuum motor 64, the pump 94, and the brush motor 96 are activated, with the pump 94 operating at a first flow rate. In the carpet cleaning mode, the vacuum motor 64, the pump 94, and the brush motor 96 are activated, with the pump 94 operating at a second flow rate which is greater than the first flow rate. The self-cleaning mode input control 40 initiates a self-cleaning mode of operation, one embodiment of which is described in detail below. Briefly, during the self-cleaning mode, a cleanout cycle can run in which cleaning liquid is sprayed on the brushroll 60 while the brushroll 60 rotates. Liquid is extracted and deposited into the recovery tank, thereby also flushing out a portion of the recovery pathway.

With reference to FIG. 3, the controller 308 can be provided at various locations on the apparatus 10, and in the illustrated embodiment is located in the upright body 12, within the frame 18, and is integrated with the SUI 32. Alternatively, the controller 308 can be integrated with the HMI 30 (FIG. 1), or can be separate from both the HMI 30 and SUI 32.

The battery 372 can be located within a battery housing 374 located on the upright body 12 or base 14 of the apparatus, which can protect and retain the battery 372 on the apparatus 10. In the illustrated embodiment, the battery housing 374 is provided on the frame 18 of the upright body 12. Optionally, the battery housing 374 can be located below the supply tank 20 and/or rearwardly of the recovery tank 22. The bumper 44 can be provided on a rear exterior side of the battery housing 374.

Referring to FIG. 19, the surface cleaning apparatus 10 can optionally be provided with a storage tray 380 that can be used when storing the apparatus 10. The storage tray 380 can be configured to receive the base 14 of the apparatus 10 in an upright, stored position. The storage tray 380 can further be configured for further functionality beyond simple storage, such as for charging the apparatus 10 and/or for self-cleaning of the apparatus 10.

Referring to FIG. 20, in the illustration embodiment, the storage tray 380 functions as a docking station for recharg-

ing the battery 372 of the apparatus 10. The storage tray 380 can optionally having at least one charging contact 382, and at least one corresponding charging contact 384 can be provided on the apparatus 10, such as on the exterior of the battery housing 374. When operation has ceased, the apparatus 10 can be locked upright and placed into the storage tray 380 for recharging the battery 372. When the apparatus 10 is removed from the storage tray 380, one or both of the charging contacts 382, 384 can be shielded, as described in further detail below. One example of a storage tray with shielded charging contacts is disclosed in U.S. Provisional Application No. 62/671,119, filed Jun. 22, 2018, which is incorporated herein by reference in its entirety.

A charging unit 386 is provided on the storage tray 380 and comprises the charging contacts 382. The charging unit 386 can electrically couple with the battery 372 when the base 14 of the apparatus 10 is docked with the storage tray 380. The charging unit 386 can be electrically coupled to a power source including, but not limited to, a household outlet. In one example, a cord 388 can be coupled with the charging unit 386 to connect the storage tray 380 to the power source.

The battery housing 374 and the charging unit 386 of the storage tray 380 can possess complementary shapes, with the battery housing 374 fitting against the charging unit 386 to help support the apparatus 10 on the storage tray 380. In the illustrated embodiment, the battery housing 374 can include a socket 390 containing the charging contacts 384 and the charging unit 386 can be at least partially received by the socket 390 when the apparatus 10 is docked with the tray 380.

FIG. 21 is a rear perspective view of a lower portion of the upright body 12 showing a cross-section through the charging contact 384 of the battery 372. A contact casing 392 can extend downwardly within the socket 390, and includes the charging contact 384, which is illustrated as DC connector or socket. The charging contact 384 or socket can be normally covered, or closed, by a retractable charging contact cover 394, also referred to herein as battery-side cover. The battery-side cover 394 can be slidably mounted to or within the casing 392 and can be biased to the normally covered position by a spring 396. When the battery-side cover 394 is in the closed position, the battery-side cover 394 shields the charging contact 384 such that liquid cannot enter the charging contact 384 or casing 392.

The battery-side cover 394 can include a ramp 398 against which a portion of the storage tray 380 presses to move the cover 394 to uncover the charging contact 384 against the biasing force of the spring 396. It is noted that while a ramp 398 is shown, the apparatus 10 can include any suitable mating feature configurable to move the cover 394 upon docking, such as a cam or a rack and pinion gear, for example. Alternatively, a linear actuator can be incorporated to move the cover 394 to the open position upon docking.

Referring to FIG. 22, the charging contact 382 of the charging unit 386, which is illustrated as DC connector or plug, can be normally covered, or closed, by a retractable charging contact cover 400, also referred to herein as tray-side cover. A bracket 402 can be provided in the charging unit to mount the charging contact or plug 382 and the cover 400. The tray-side cover 400 can be biased to the normally covered position by springs 404, 406, which bias the cover 400 rearwardly and upwardly. When the tray-side cover 400 is in the closed position, the tray-side cover 400 shields the charging contact 382 such that liquid cannot enter the charging contact 382 or charging unit 386.

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The tray-side cover 400 can include a ramp 408 against which a portion of the apparatus 10 presses to move the cover 400 to uncover the charging contact 382 against the biasing force of the springs 404, 406. It is noted that while a ramp 408 is shown, the apparatus 10 can include any suitable mating feature configurable to move the cover 400 upon docking, such as a cam or a rack and pinion gear, for example. Alternatively, a linear actuator can be incorporated to move the cover 400 to the open position upon docking.

Docking the apparatus 10 with the storage tray 380 can automatically move the covers 394, 400 to an uncovered or open position, an example of which is shown in FIGS. 23-25, in which the charging contacts 382, 384 can be coupled, i.e. by the socket 384 receiving the plug 382. In one embodiment, in order to dock the apparatus 10 within the storage tray 380 for charging, the apparatus 10 is lowered into the storage tray 380 as shown in FIG. 23 and the casing 392 pushes against the ramp 408 on the tray-side cover 400, sliding the cover 400 forwardly to expose the charging contact or plug 382. As the apparatus 10 continues to be lowered onto the storage tray 380, the exposed plug 382 presses against the ramp 398 on the battery-side cover 394, as shown in FIG. 24, sliding the cover 394 laterally to expose the charging contact or socket 384. Continued lowering of the apparatus 10 plugs the plug 382 into the socket 384, as shown in FIG. 25. The charging plug 382 on the storage tray 380 and socket 384 on the apparatus 10 become fully engaged, or electrically connected, when the apparatus 10 is fully seated on the storage tray 380.

Referring back to FIGS. 19-20, during use, the apparatus 10 can get very dirty, particularly in the brush chamber 104 and extraction pathway, and can be difficult for the user to clean. The storage tray 380 can function as a cleaning tray during a self-cleaning mode of the apparatus 10, which can be used to clean the brushroll 60 and internal components of the fluid recovery pathway of apparatus 10. Self-cleaning using the storage tray 380 can save the user considerable time and may lead to more frequent use of the apparatus 10. The storage tray 380 can optionally be adapted to contain a liquid for the purposes of cleaning the interior parts of apparatus 10 and/or receiving liquid that may leak from the supply tank 20 while the apparatus 10 is not in active operation. When operation has ceased, the apparatus 10 can be locked upright and placed into the storage tray 380 for cleaning. The apparatus 10 is prepared for self-cleaning by filling the storage tray 380 to a predesignated fill level with a cleaning liquid, such as water. The user can select the self-cleaning mode via the input control 40 (FIGS. 1 and 18). In one example, during the self-cleaning mode, the vacuum motor 64 and brush motor 96 are activated, which draws cleaning liquid in the storage tray 380 into the fluid recovery pathway. The self-cleaning mode can be configured to last for a predetermined amount of time or until the cleaning liquid in storage tray 380 has been depleted. Examples of self-cleaning cycles and storage trays are disclosed in U.S. Patent Application Publication No. 2018/0344112, filed May 31, 2018, which is incorporated herein by reference in its entirety.

The tray 380 can physically support the entire apparatus 10. More specifically, the base 14 can be seated in the tray 380. The tray 380 can have a recessed portion in the form of a sump 410 in register with at least one of the suction nozzle 54 or brushroll 60. Optionally, the sump 410 can sealingly receive the suction nozzle 54 and brushroll 60, such as by sealingly receiving the brush chamber 104. The sump 410 can fluidly isolate, or seal, the suction nozzle 54 and fluid distributor 90 (FIG. 5) within the brush chamber 104 to

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create a closed loop between the fluid delivery and fluid recovery systems of the apparatus 10. The sump 410 can collect excess liquid for eventual extraction by the suction nozzle 54. This also serves to flush out a recovery pathway between the suction nozzle 54 and the recovery tank 22.

FIG. 26 is a perspective view of the storage tray 380. The tray 380 can include guide walls 412 extending upwardly and configured to align the base 14 within the tray 380. A rear portion of the tray 380 can comprise wheel holders 414 for receiving the rear wheels 72 of the apparatus 10. The wheel holders 414 can be formed as a recess, or groove in the storage tray 380, and can be provided on opposite lateral sides of the charging unit 386.

Optionally the storage tray 380 can include a removable accessory holder 416 for storing one or more accessories for the apparatus 10. The accessory holder 416 can be provided on an exterior side wall of the tray 380, and can be removably mounted to the tray 380. The tray 380 can optionally be provided with a mounting location on either lateral side of the tray 380 to allow the user some flexibility in where the accessory holder 416 is attached. FIG. 26 includes an accessory holder 416 in phantom line showing one optional alternative mounting location. The mounting locations can include a retention latch, sliding lock, clamp, brace, or any other mechanism in which to secure accessory holder 416 on the storage tray 380. Alternatively, storage tray 380 can be configured with a non-removable or integral accessory holder 416.

The illustrated accessory holder 416 can removably receive one or more brushrolls 60 and/or one or more filters 276 for the purposes of storage and/or drying. Accessory holder 416 can comprise one or more brushroll slots 418 to securely receive brushrolls 60 in a vertical fixed position for drying and storage. Brushroll slots 418 can be fixed or adjustable and can be comprised of clamps, rods, or molded receiving positions that can accommodate brushroll 546 with or without the dowel 110 inserted. Accessory holder 416 can comprise at least one filter slot 420 to securely receive filter 276 in a vertical fixed position for drying and storage. Alternatively, accessory holder 416 can store the brushrolls 60 and filter 276 in a variety of other positions.

FIG. 27 is a block diagram for the apparatus 10, showing a condition when the apparatus 10 is docked with the storage tray 380 for recharging. The apparatus 10 includes a battery charging circuit 430 that controls recharging of the battery 372. When the apparatus 10 is docked with the storage tray 380, as shown in FIG. 20, the battery charging circuit 430 is active and the battery 372 is charged. In at least some embodiments of the storage tray 380, the tray 380 includes power cord 388 plugged into a household outlet, such as by a wall charger 432 having, for example an operating power of 35 W. However, during a self-cleaning cycle during which the vacuum motor 64, pump 94, and brush motor 96 are all energized, the required power draw can far exceed the operating power of the wall charger 432. In one example, the required power draw for the vacuum motor 64, pump 94, and brush motor 96 can be 200-250 W. The apparatus 10 can include a battery monitoring circuit 433 for monitoring the status of the battery 372 and individual battery cells contained therein. Feedback from the battery monitoring circuit 433 is used by the controller 308 to optimize the discharging and recharging process, as well as for displaying battery charge status on the SUI 32.

Referring to FIG. 28, the block diagram shows a condition when the apparatus 10 is docked with the storage tray 380 in the self-cleaning mode. Actuating (e.g. depressing) the self-cleaning mode input control 40 disables or shuts off the

battery charging circuit 430, and allows the apparatus 10 to energize and be powered by the onboard battery 472. The apparatus 10 then automatically cycles through the self-cleaning mode, and during this cycle the battery charging circuit 430 remains disabled, i.e. the battery 372 does not recharge during the self-cleaning mode. This operational behavior is beneficial because if the battery charging circuit 430 is not disabled and power not supplied by the battery 472 during the self-cleaning mode, the capacity of the wall charger 432 can be exceeded. As noted above, in one embodiment the wall charger 432 can have, for example, an operating power of 35 W. Wall chargers with higher capacity are much more expensive.

FIG. 29 depicts one aspect of the disclosure of a self-cleaning method 440 for the apparatus 10 using the storage tray 380. In use, a user at 442 docks the apparatus 10 with the storage tray 380. The docking may include parking the base 14 on the cleaning tray 380 and establishing a closed loop between the fluid delivery and fluid recovery systems of the apparatus 10. For example, the docking can include sealing the brush chamber 104 to establish a sealed cleaning pathway between the fluid distributor 90 and the suction nozzle 54.

At step 444, the charging circuit 430 is enabled when the apparatus 10 is docked with the tray 380 and the charging contacts 382, 384 couple. When the charging circuit 430 is enabled, the battery 372 may begin being recharged.

At step 446, the cleanout cycle for the self-cleaning mode of operation is initiated. The controller 308 can initiate the cleanout cycle based on input from the user, such as by the user pressing the self-cleaning mode input control 40 on the SUI 32. The self-cleaning cycle may be locked-out by the controller 308 when the apparatus 10 is not docked with the storage tray 380 to prevent inadvertent initiation of the self-cleaning cycle.

At step 448, upon initiation of the self-cleaning cycle, such as upon the user pressing the self-cleaning mode input control 40, the charging circuit 430 is disabled, i.e. the battery 372 ceases to recharge.

Pressing the input control 40 at step 446 can energize one or more components of the apparatus 10 to energize and be powered by the onboard battery 472. The self-cleaning cycle may begin at step 450 in which the pump 94 is active to deliver cleaning fluid from the supply tank 20 to the distributor 90 that sprays the brushroll 60. During step 450, the brush motor 96 can also activate to rotate the brushroll 60 while applying cleaning fluid to the brushroll 60 to flush the brush chamber 104 and cleaning lines, and wash debris from the brushroll 60. The self-cleaning cycle may use the same cleaning fluid normally used by the apparatus 10 for surface cleaning, or may use a different detergent focused on cleaning the recovery system of the apparatus 10.

The vacuum motor can be actuated during or after step 450 to extract the cleaning fluid via the suction nozzle 54. During extraction, the cleaning fluid and debris from the sump 410 in the tray 380 is sucked through the suction nozzle 54 and the downstream fluid recovery path. The flushing action also cleans the entire fluid recovery path of the apparatus 10, including the suction nozzle 54 and downstream conduits.

At step 452, the self-cleaning cycle ends. The end of the self-cleaning cycle can be time-dependent, or can continue until the recovery tank 22 is full or the supply tank 20 is empty. For a timed self-cleaning cycle, the pump 94, brush motor 96, and vacuum motor 64 are energized and de-energized for predetermined periods of time. Optionally, the pump 94 or brush motor 96 can pulse on/off intermittently

so that any debris is flushed off of the brushroll 60 and extracted into the recovery tank 22. Optionally, the brushroll 60 can be rotated at slower or faster speeds to facilitate more effective wetting, shedding of debris, and/or spin drying. Near the end of the cycle, the pump 94 can de-energize to end fluid dispensing while the brush motor 96 and vacuum motor 64 can remain energized to continue extraction. This is to ensure that any liquid remaining in the sump 410, on the brushroll 60, or in the fluid recovery path is completely extracted into the recovery tank 22.

After the end of the self-cleaning cycle, the charging circuit 430 is enabled to continue to recharging the battery 472 at step 454.

To the extent not already described, the different features and structures of the various embodiments of the invention, may be used in combination with each other as desired, or may be used separately. That one surface cleaning apparatus is illustrated herein as having all of these features does not mean that all of these features must be used in combination, but rather done so here for brevity of description. Furthermore, while the surface cleaning apparatus 10 shown herein has an upright configuration, the surface cleaning apparatus can be configured as a canister or portable unit. For example, in a canister arrangement, foot components such as the suction nozzle and brushroll can be provided on a cleaning head coupled with a canister unit. Still further, the surface cleaning apparatus can additionally have steam delivery capability. Thus, the various features of the different embodiments may be mixed and matched in various vacuum cleaner configurations as desired to form new embodiments, whether or not the new embodiments are expressly described.

The above description relates to general and specific embodiments of the disclosure. However, various alterations and changes can be made without departing from the spirit and broader aspects of the disclosure as defined in the appended claims, which are to be interpreted in accordance with the principles of patent law including the doctrine of equivalents. As such, this disclosure is presented for illustrative purposes and should not be interpreted as an exhaustive description of all embodiments of the disclosure or to limit the scope of the claims to the specific elements illustrated or described in connection with these embodiments. Any reference to elements in the singular, for example, using the articles "a," "an," "the," or "said," is not to be construed as limiting the element to the singular.

Likewise, it is also to be understood that the appended claims are not limited to express and particular compounds, compositions, or methods described in the detailed description, which may vary between particular embodiments that fall within the scope of the appended claims. With respect to any Markush groups relied upon herein for describing particular features or aspects of various embodiments, different, special, and/or unexpected results may be obtained from each member of the respective Markush group independent from all other Markush members. Each member of a Markush group may be relied upon individually and or in combination and provides adequate support for specific embodiments within the scope of the appended claims.

The invention claimed is:

1. A surface cleaning system, comprising:
  - a storage tray configured to dock a surface cleaning apparatus in an upright storage position; and
  - the surface cleaning apparatus comprising:
    - an upright body comprising a handle and a frame;
    - a base coupled with the upright body and adapted for movement across a surface to be cleaned;

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- a moveable joint assembly mounting the base to the upright body, wherein the upright body is pivotable via the joint assembly between the upright storage position and a reclined use position;
- a fluid delivery system comprising a supply tank, a pump, and a fluid distributor;
- a recovery system comprising a recovery pathway, a recovery tank, a suction nozzle, and a vacuum motor;
- a brushroll within the recovery pathway of the recovery system;
- a brushroll motor operably coupled to the brushroll for rotating the brushroll, wherein the recovery system is configured to extract fluid and debris from the brushroll, transport fluid and debris through the recovery pathway and deposit into the recovery tank;
- a rechargeable battery configured to selectively power the pump, the brushroll motor, and the vacuum motor;
- at least one controller configured to initiate an unattended automatic cleanout mode of operation in response to a user selection, during which the pump, the brushroll motor, and the vacuum motor are energized;
- a battery charging circuit for controlling the recharging of the rechargeable battery; and
- wherein the at least one controller is configured to detect that the surface cleaning apparatus is docked with the storage tray and initiate the unattended automatic cleanout mode of operation; and
- wherein battery recharging is disabled during the unattended automatic cleanout mode of operation and remains disabled when either the brushroll motor or the vacuum motor is energized.
- 2.** The surface cleaning system of claim 1, wherein the at least one controller is configured to:
- energize the pump and the brushroll motor during the unattended automatic cleanout mode of operation, whereby cleaning liquid is sprayed on the brushroll and the brushroll rotates; and
- energize the vacuum motor after the pump and the brushroll motor during the unattended automatic cleanout mode of operation, whereby cleaning liquid is extracted and deposited into the recovery tank and a portion of the suction nozzle is flushed out.
- 3.** The surface cleaning system of claim 2, wherein the at least one controller is configured to de-energize the pump during the unattended automatic cleanout mode of operation while the brushroll motor and the vacuum motor remain energized.
- 4.** The surface cleaning system of claim 2, wherein the at least one controller is configured to de-energize the pump during the unattended automatic cleanout mode of operation while the brushroll motor and the vacuum motor remain energized, and wherein battery recharging is disabled while the brushroll motor and the vacuum motor remain energized.
- 5.** The surface cleaning system of claim 2, wherein the at least one controller is configured to de-energize the pump during the unattended automatic cleanout mode of operation while the vacuum motor remains energized, and wherein battery recharging is disabled while the vacuum motor remains energized.
- 6.** The surface cleaning system of claim 1, wherein the at least one controller is configured to de-energize the pump during the unattended automatic cleanout mode of operation while the brushroll motor and the vacuum motor remain energized.

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- 7.** The surface cleaning system of claim 1, wherein the at least one controller selectively energizes the brushroll motor by the rechargeable battery during the unattended automatic cleanout mode of operation while the vacuum motor remains de-energized.
- 8.** The surface cleaning system of claim 1, wherein the storage tray comprises a recessed portion for receiving a brushroll chamber of the surface cleaning apparatus whereby cleaning liquid is captured during the unattended automatic cleanout mode of operation, wherein at least a portion of the cleaning liquid captured by the recessed portion of the storage tray is extracted when the vacuum motor is energized into the recovery tank during the unattended automatic cleanout mode of operation.
- 9.** The surface cleaning system of claim 1, wherein battery recharging is disabled when at least one of the brushroll motor or the vacuum motor are energized.
- 10.** The surface cleaning system of claim 1, wherein the at least one controller disables charging during the unattended automatic cleanout mode of operation and the at least one controller automatically enables charging after the end of the unattended automatic cleanout mode of operation.
- 11.** The surface cleaning system of claim 1, wherein the battery charging circuit is enabled when the surface cleaning apparatus is docked with the storage tray.
- 12.** A surface cleaning system comprising:
- a storage tray configured to dock a surface cleaning apparatus in an upright storage position for recharging a battery of the surface cleaning apparatus and for self-cleaning of the surface cleaning apparatus, the storage tray comprising at least one charging contact, a power cord, and a wall charger configured to be plugged into a household outlet; and
- the surface cleaning apparatus comprising:
- an upright body comprising a handle and a frame;
- a base coupled with the upright body and adapted for movement across a surface to be cleaned;
- a moveable joint assembly mounting the base to the upright body, wherein the upright body is pivotable via the joint assembly between the upright storage position and a reclined use position;
- a fluid delivery system comprising a supply tank removable from the frame, a pump, and a fluid distributor;
- a recovery system comprising a recovery pathway, a recovery tank, a suction nozzle, and a vacuum motor;
- a brushroll within the recovery pathway of the recovery system;
- a brushroll motor operably coupled to the brushroll for rotating the brushroll, wherein the suction nozzle is configured to extract fluid and debris from the brushroll;
- a rechargeable battery, operably connected to at least one controller, configured to selectively energize the pump, the vacuum motor, and the brushroll motor;
- a self-cleaning mode input control disposed on the upright body operably connected to at least one controller, wherein the at least one controller is configured to execute an unattended automatic cleanout mode of operation during which each one of the pump, the brushroll motor, and the vacuum motor are energized; and
- the at least one controller further configured to control the operation of the fluid delivery and recovery systems of the surface cleaning apparatus during the unattended automatic cleanout mode of operation; and

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wherein the surface cleaning apparatus comprises at least one corresponding charging contact configured to couple with the at least one charging contact of the storage tray when the surface cleaning apparatus is docked with the storage tray;

wherein the at least one controller is configured to execute the unattended automatic cleanout mode of operation as a result of the actuation of the self-cleaning mode input control, and wherein the self-cleaning mode of operation is operable only when the surface cleaning apparatus is docked on the storage tray; and

wherein the controller is further configured to disable a battery charging circuit, wherein the battery charging circuit stops charging the rechargeable battery as a result of the actuation of the self-cleaning mode input control.

**13.** The surface cleaning system of claim **12**, wherein the wall charger has a predetermined operating power and further wherein the at least one controller disables recharging as a result of the actuation of the self-cleaning mode input control to avoid exceeding the predetermined operating power of the wall charger during the unattended automatic cleanout mode of operation.

**14.** The surface cleaning system of claim **12**, wherein the at least one controller disables charging when at least one of the brushroll motor or the vacuum motor are energized during the unattended automatic cleanout mode of operation.

**15.** The surface cleaning system of claim **12**, wherein the at least one controller is configured to de-energize the pump and the brushroll motor during the unattended automatic cleanout mode of operation while the vacuum motor remains energized.

**16.** The surface cleaning system of claim **15**, wherein the at least one controller is configured to detect whether the surface cleaning apparatus is docked with the storage tray and prevent execution of the unattended automatic cleanout mode of operation when the at least one controller detects the surface cleaning apparatus is not docked.

**17.** A surface cleaning apparatus, comprising:

an upright body comprising a handle and a frame;

a base coupled with the upright body and adapted for movement across a surface to be cleaned;

a moveable joint assembly mounting the base to the upright body, wherein the upright body is pivotable via the joint assembly between an upright storage position and a reclined use position;

a fluid delivery system comprising a supply tank, a pump, and a fluid distributor;

a recovery system comprising a recovery pathway, a recovery tank, a suction nozzle, and a vacuum motor;

a brushroll within the recovery pathway of the recovery system;

a brushroll motor operably coupled to the brushroll for rotating the brushroll, wherein the suction nozzle is configured to extract fluid and debris from the brushroll;

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a rechargeable battery, operably coupled to at least one controller, configured to selectively energize the pump, the brushroll motor, and the vacuum motor;

the at least one controller configured to control a battery charging circuit, for recharging of the rechargeable battery; and

a self-cleaning mode configured to initiate an unattended automatic cleanout mode of operation during which each of the pump, the brushroll motor, and the vacuum motor are energized;

the at least one controller further configured to execute the unattended automatic cleanout mode of operation by: energizing the pump to spray cleaning liquid from the supply tank onto the brushroll;

energizing the brushroll motor to rotate the brushroll; and

energizing the vacuum motor to extract cleaning liquid and flush out a portion of the suction nozzle;

wherein the at least one controller disables the battery charging circuit from charging the rechargeable battery during the unattended automatic cleanout mode of operation.

**18.** The surface cleaning apparatus of claim **17**, wherein the at least one controller is configured to execute the unattended automatic cleanout mode of operation by energizing the vacuum motor after energizing the brushroll motor and after energizing the pump.

**19.** The surface cleaning apparatus of claim **17**, wherein the at least one controller is configured to execute the unattended automatic cleanout mode of operation by de-energizing the pump to end cleaning liquid dispensing while the brushroll motor and the vacuum motor remain energized by the battery.

**20.** The surface cleaning apparatus of claim **17**, wherein the at least one controller is configured to de-activate the brushroll motor to stop the brushroll from rotating while the vacuum motor remains energized.

**21.** The surface cleaning apparatus of claim **17**, comprising a status user interface on the upright body, wherein the status user interface comprises a display, the display comprising a battery status indicator.

**22.** The surface cleaning apparatus of claim **21**, comprising a battery monitoring circuit, operably connected to the at least one controller, wherein feedback from the battery monitoring circuit is used to display battery charge status on the status user interface.

**23.** The surface cleaning apparatus of claim **21**, wherein the display comprises a self-cleaning status indicator.

**24.** The surface cleaning apparatus of claim **17**, comprising a battery housing in which the rechargeable battery is located, the battery housing configured to protect the battery from fluid.

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